

PUBLIC WORKS

City, County and State

June, 1961



Officials of Chicago's Department of Water and Sewers shown examining a model of the Central District Filtration Plant now under construction are: James W. Jardine, Commissioner; W. W. DeBerard, Chief Water Engineer; H. H. Gerstein, Asst. Chief Water Engineer; and John R. Baylis, Engineer of Water Filtration. More on page 18.

The Flamingo

Nature's Microstrainer

... has a feeding structure unique among birds which is one of the most extraordinary in the world. When these birds feed the long neck bends gracefully down and swings gently to and fro straining great quantities of water to extract the micro organisms present. In the flamingo, the boxlike bill provides a beautiful mechanism for this purpose. It is opened by raising the upper jaw thereby producing a slit-like gap with serrated edges which permit only small particles to enter with the water. Within the bill is a series of horny ridges acting as strainers over which the tongue of the flamingo runs backward and forward with a piston like motion; as the tongue draws back, water enters ... as it goes forward the water is expelled, the process being repeated as often as four times per second. Microscopic animals or plants as small as 1/50 of an inch in diameter are strained out and later swallowed with the help of backwardly directed splines found on the tongue.



The beautiful method of extracting organisms by the flamingo has for its parallel in the mechanical world the action of the Glenfield MICROSTRAINER. Highly skilled fabric weaving, however, enables MICROTRAINING® to improve on the performance of the flamingo by removing particles as fine as 1/1000 of an inch in diameter.

A product of years of research and stringent field tests by a firm with over a century of hydraulic engineering experience, the GLENFIELD MICROTRAINING units are automatically and continuously operated under open gravity conditions with small head losses.

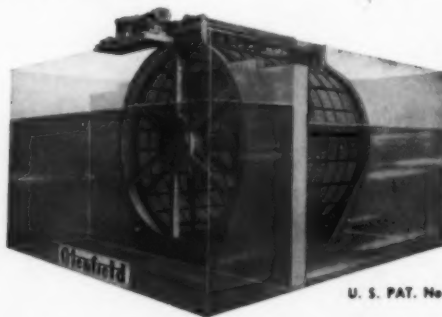
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Filtration of secondary sewage effluents.

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Bulletin 145

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Bulletin 175-A

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Bulletin 191

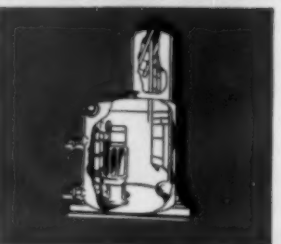
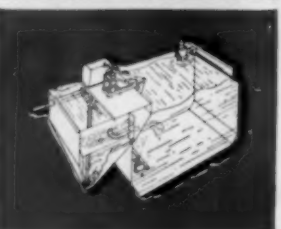
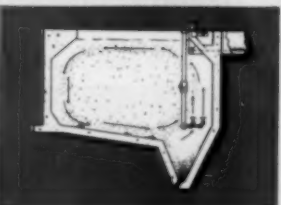
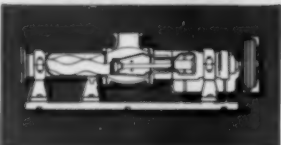
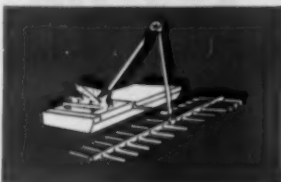
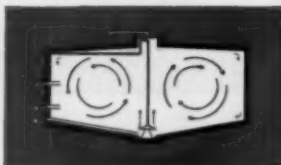
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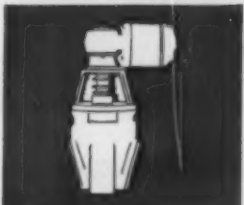
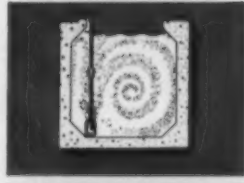
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NEW 4R COMMUNUTOR TWO-WAY 4" CUTTING MACHINE — Increased cutting capacity with longer cutter life.

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Putting Ideas to Work

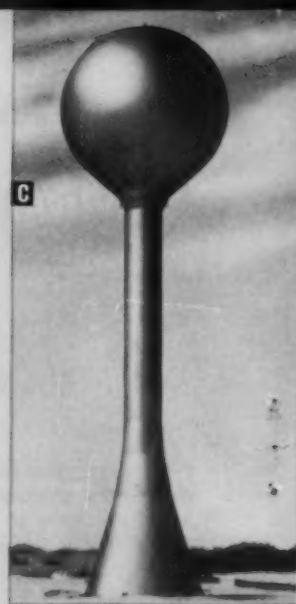
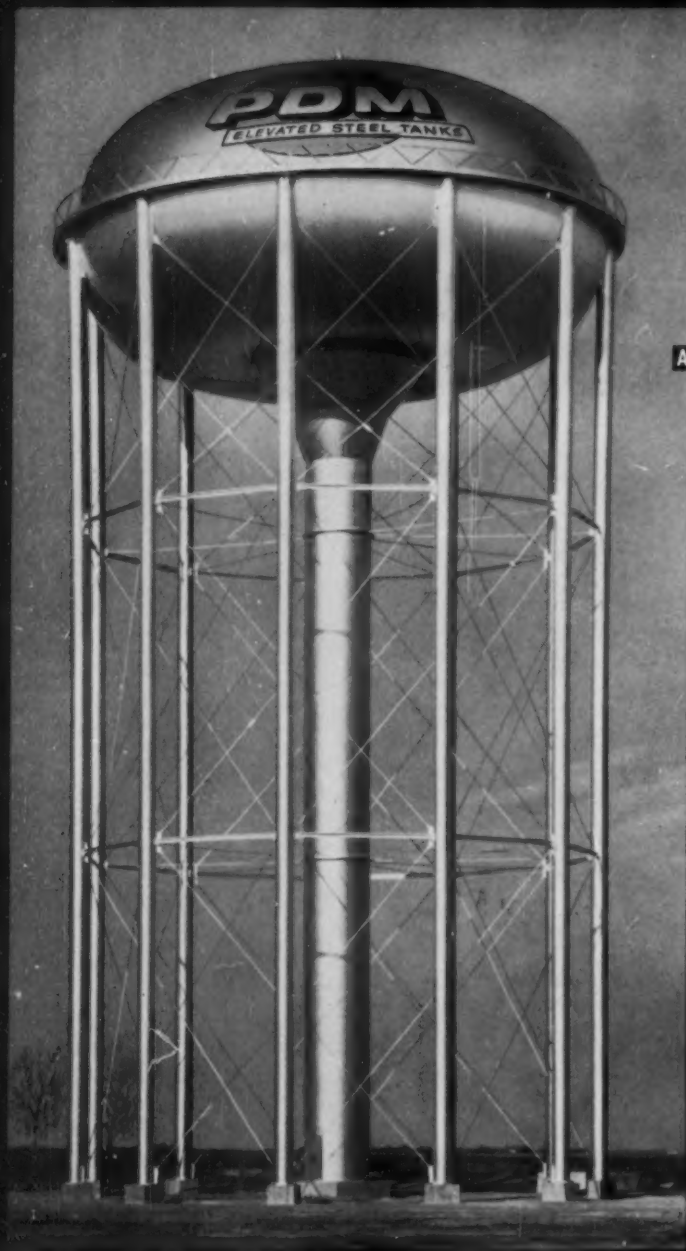
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HYDRODYNAMICS DIVISION

CHICAGO PUMP

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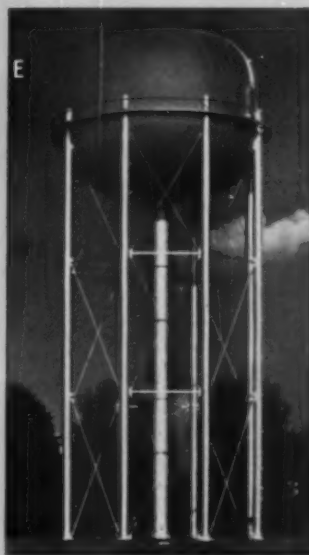
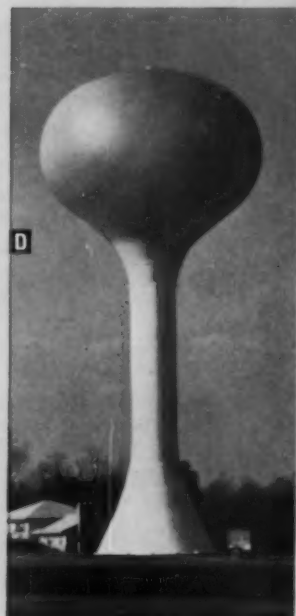
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PUBLIC WORKS

THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES

JUNE, 1961 • Volume 92, Number 6

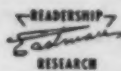
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<i>Construction of the Central District Filtration Plant will complete Chicago's program to provide filtered water for the entire city.</i>	<i>New vehicular tunnel in Fort Lauderdale, Fla., now averages about 25,000 cars daily.</i>
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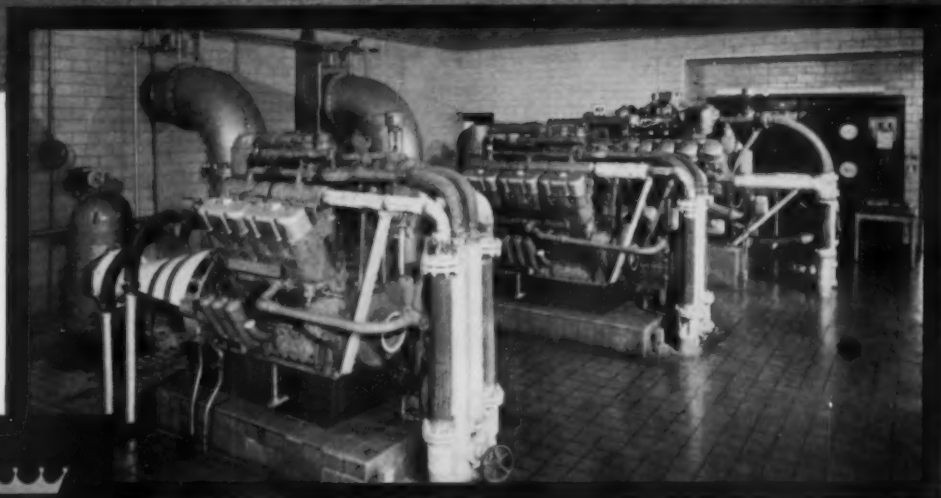


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Pumping fifteen to twelve million gallons! Joliet's city sewage treatment plant does it—every day.

The Worthington sewage pumps are driven through Amarillo right angle gears by ROILINE Engines *using sewage gas for fuel.*

ROILINE Model L-3000 runs *continuously*, 107 hp at 545 rpm, capacity 10,400 gpm;

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ROILINE Model H-2000 as an *auxiliary*, 75 hp at 637 rpm, capacity 7,300 gpm; 8-cyl., 6¾-in. bore x 7-in. stroke, 2004 cu. in. displ.

ROILINE Model L-3460 as a *standby*, 151 hp at 530 rpm, capacity 15,300 gpm; 12-cyl., 7¼-in. bore x 7-in. stroke, 3468 cu. in. displ.

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PUBLIC WORKS for June, 1961



The Maintenance Needs of Our Highways and Streets

FOR MANY YEARS the total cost of county and township highways and of city streets has been split about evenly between maintenance and construction. When Federal and state highways are included, especially the Interstate system, overall maintenance expenditures are about 40 percent; or, for 1975, about \$4.3 billion according to recent estimates. However, cities, counties and townships will still spend some 48 cents of every highway dollar for maintenance.

There is need for more and better maintenance equipment and the only place this equipment will do any good is on our highways and streets, working regularly. This means that not only must manufacturers develop more useful designs but they must also sell these improved designs to the men responsible for maintaining our streets and roads. To us, it appears that this important field of selling maintenance tools has been somewhat neglected, perhaps because it has been overshadowed by spectacular construction programs. It is time to view in a new light the overriding necessity of keeping our costly highways in the best possible condition to carry traffic and to leave nothing undone that will make this necessary work less costly and more effective.

For More Progress in Water and Waste Treatment

THERE ARE indications that, in some areas, a greater degree of treatment will have to be provided for sewage and industrial wastes. To the present steadily rising costs of such treatment may then be added a top layer for tertiary treatment. Every effort should be made to reduce such costs.

The development of new processes and equipment by manufacturers is costly, and seldom are such developments accepted by state sanitary engineering departments except after lengthy tests in another state. The result is an added cost burden on manufacturers and a slow-down in forward progress.

Both these problems could be alleviated by formation of a joint committee on equipment and methods. Such a group should include manufacturers, contractors, state health departments, consulting engineers, public works officials and the Public Health Service. Problems of new equipment development

and acceptance by regulatory agencies could be defined and discussed or decided by this agency. The results could include greater incentive for new developments, with increased progress in the field; and possibly lower costs through realistic consideration of construction phases by contractor and engineer groups.

A Test of Patience

NO SINGLE research project in the history of our highway industry is likely to have a more far-reaching influence on our national highway program than the AASHO road test. This influence, however, can be seriously damaged, in the eyes of the general public and of legislative bodies, by premature interpretation of the probable results. The truck traffic phase of the test was completed last November but the demanding and vital work of tabulating, correlating and analyzing the exhaustive data gathered, is a long way from being completed. Until it is done, there are no valid results on which to base conclusions.

There are a lot of lessons to be learned from the AASHO road test. One of them is patience.

Better Lighting Pays

MERCHANTS in retail districts and shopping centers have long known that customers are like moths in one respect at least—bright lighting attracts them. So they have not hesitated to lend a hand in financing such lighting as an investment that pays excellent returns. But beyond these shopping areas most of America remains in comparative darkness. By present standards, average street lighting is obsolete; and highway lighting far behind the modern design of our new highways.

As one industry spokesman has put it: "Nobody complains that sunlit streets are too bright—10,000 footcandles and no complaints. Yet the Illuminating Engineering Society recommendations for street lighting residential streets are in use on only sixteen of every 100 miles of residential streets in the U. S." The real meaning of this is that nearly eight and one-half out of every ten miles of residential streets are literally in the dark as to what makes real modern street lighting. Better lighting precedes lessening of crime and traffic accidents, as well as increasing retail sales and property values. It is high time to wake up—and light up!

TRAXCAVATORS...fast...safe...

ALWAYS READY TO GO



easy to operate WHEN YOU NEED 'EM

◀ The town of Canaan, New York, and the township use this 955 Traxcavator to widen gravel roads, load gravel and plow snow. The operator says this 955 is three times better than previous machine. Power shift transmission speeds operation. Lifetime lubricated rollers and dry-type engine air cleaner cut maintenance time.

3 TRACK-TYPE TRAXCAVATORS

933—1½ YD. STD. BUCKET—52 HP (flywheel)
Cat Diesel Engine—direct drive transmission with Cat exclusive oil clutch.

955—1¾ YD. STD. BUCKET—100 HP (flywheel)
Cat Diesel Engine, turbocharged for efficiency—single lever control power shift transmission.

977—2½ YD. STD. BUCKET—150 HP (flywheel)
Cat Diesel Engine, turbocharged for efficiency—single lever control power shift transmission.

◀ Franklin Township Road Dept., Murrysville, Pa., uses this 944 Traxcavator summer and fall for widening, repairing and building roads . . . plowing, cindering and keeping roads open in winter. To get equipment that's ready to go when they need it, Franklin Township purchases on a best buy basis, not necessarily on low bid.

3 WHEEL-TYPE TRAXCAVATORS

922—1¼ YD. STD. BUCKET—80 HP (flywheel)
Cat Diesel Engine, turbocharged for efficiency (gasoline engine also available)—Cat power shift transmission—four forward speeds—four reverse speeds.

944—2 YD. STD. BUCKET—105 HP (flywheel)
Cat Diesel Engine, turbocharged for efficiency (gasoline engine also available)—Cat power shift transmission—four forward speeds—four reverse speeds.

966—2¾ YD. STD. BUCKET—140 HP (flywheel)
Cat Diesel Engine, turbocharged for efficiency—Cat power shift transmission—four forward speeds—four reverse speeds.

The unpleasant truth is . . . you can use up more of your budget maintaining an undependable machine than you spend on the loader that's always ready to do your jobs.

Your own records will show Traxcavators' unmatched dependability. Cities and counties, contractors and industrial companies have recorded operating costs and machine service hours that unquestionably prove that you can get more work out of Traxcavators than other loaders. Traxcavators are built better. And the Caterpillar Dealer keeps a full inventory of parts so that when your loader does need a quick repair you get fast service . . . constant availability.

And you get more than availability . . . you get the easiest operating, *fastest* loaders on the market. With power shift transmissions, automatic controls, Traxcavators make good operators even better in a hurry.

And when you need high production—need to load or feed 4000-5000 tons of material a day—look to the big 977 track-type or 966 wheel Traxcavators.

All your work, the tough stuff, the easy jobs . . . they're all handled faster and easier with a Traxcavator. Call your Caterpillar Dealer . . . do business with the man whose business is built on dependability.

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SAFETY Lift arms and cylinders are all forward of the operator, give him complete freedom of movement; good visibility and automatic bucket positioners help him get top performance from the machine. Heavy frame and the design geometry give excellent stability.

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POWER SHIFT TRANSMISSIONS Fast, effortless power shifting in first and second speeds, forward-reverse gives 25-second cycles to make each operation faster and easier. (On all but the 933 track-type loader.) Wheel loaders have 4-wheel drive for work, 2-wheel drive for travel.

SIDE DUMP BUCKET Interchangeable with the standard bucket, exclusive Cat side dump bucket eliminates turning, requires less loading space . . . dumps to left or forward. Lift forks, special material buckets and other attachments are available to make your Traxcavator more versatile the year 'round.

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**TRAXCAVATORS
ARE MAKING OTHER
LOADERS OBSOLETE**



Bill Coslett and Dick Griffith deliver a sales pitch Alcoa didn't pay for!

"SIGN MATERIALS? We've tried 'em all . . . but nothing works like aluminum!" says William H. Coslett, manager of Traffic Safety and Service Department, Wilkesburg, Pa.

Borough Manager Richard O. Griffith explained, "At my request, Bill Coslett worked out a complete replacement program for street, stop and safety signs. We compared many prices, many materials, many sources. An experimental program proved aluminum with reflective

sheeting to be best for Wilkesburg's needs."

"We checked other aluminum manufacturers," according to Bill Coslett, "but no one gave us the help Alcoa did. They even came out to our sign shop . . . showed us how to use and work with aluminum.

"Our aluminum street and stop signs are light in weight—yet plenty strong! They're easier to maintain because they'll never rust. Aluminum keeps its sharp lines and good looks for years," Mr. Coslett added.



Clarence H. Schreiber, Wilkinsburg's Chief of Police, discusses the added safety value of new Alcoa Aluminum Stop Signs with Burgess H. R. Rowland. In the background, maintenance crewman William Rosenberry installs new, easy-to-read Alcoa Aluminum street name signs.



Council approval was unanimous for aluminum!

PS—This is a true story. In the fall of 1959, the Borough Council of Wilkinsburg decided on Alcoa® Aluminum for their street and stop signs. The replacement program is now almost complete. And Wilkinsburg is already saving money due to reduced maintenance.

Call your nearest Alcoa sales office and learn how *your* community can stretch tax dollars with Alcoa Aluminum Street and Stop Signs, and at the same time qualify for the big FREE "Welcome to Your Town" sign. Or write: Aluminum Company of America, 897-F Alcoa Building, Pittsburgh 19, Pa.



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Rugged, every inch of the way

Cast iron pipe was made for tough jobs such as sewage disposal. It resists attack by sewage and sewage gases that require expensive linings in other types of pipe; it keeps sewage flowing smoothly.

Cast iron pipe performs a tough job. It stands up to external and internal loads, shocks and pressures. Bottle-tight joints *eliminate* seepage and infiltration at the most vulnerable points of your system.

Cast iron pipe is rugged every inch of the way . . . and will remain so for over a century.



CAST IRON PIPE

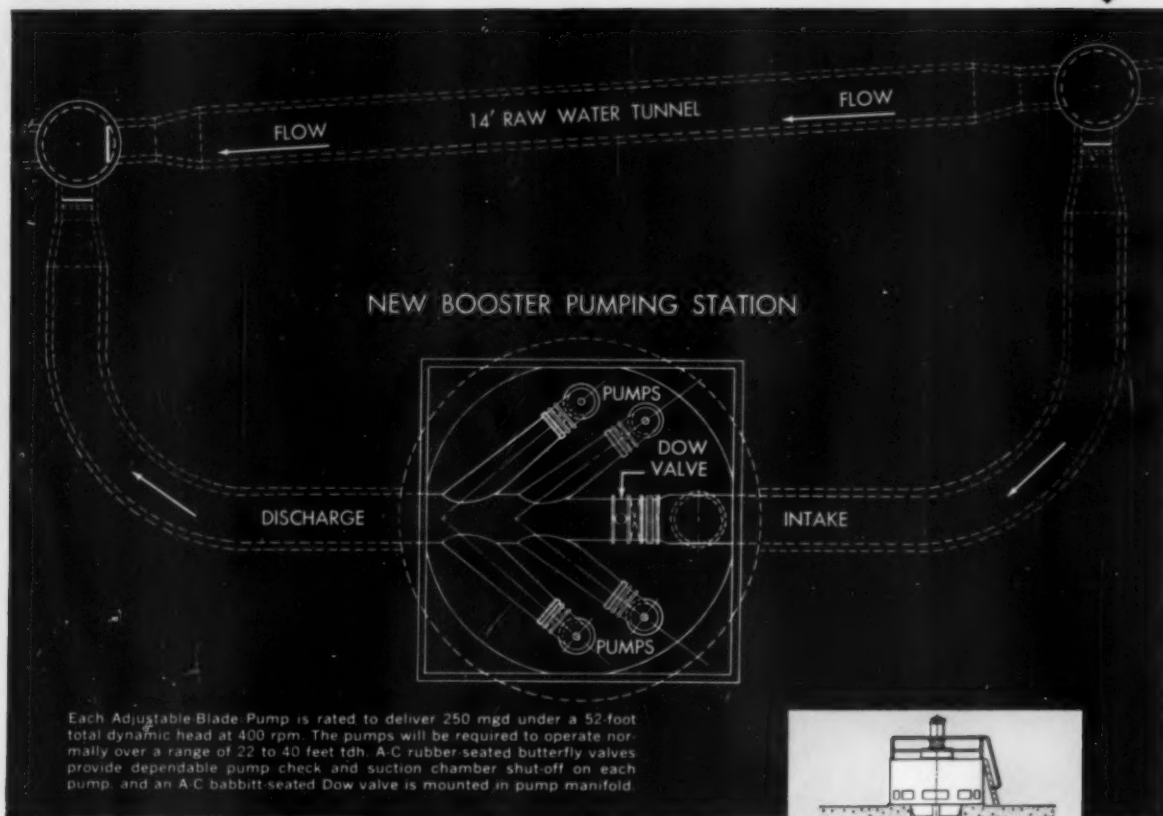
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CAST IRON PIPE RESEARCH ASSOCIATION

Thos. F. Wolfe, Managing Director, 9440 Prudential Plaza, Chicago 1, Illinois



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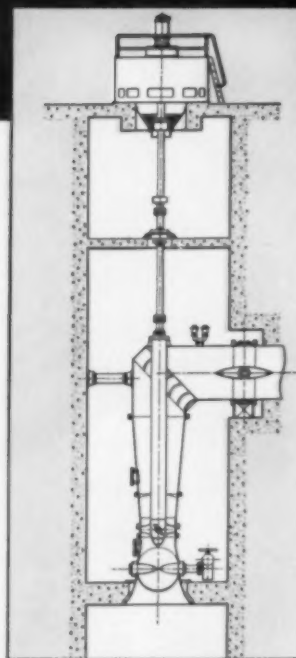
A-C Adjustable-Blade Pumps help City of Detroit augment raw water supply!

To augment the supply of raw water, Detroit, Michigan has installed four A-C Adjustable-Blade Pumps in a new booster pumping plant near the Detroit River. Pumps of this type were selected for their rapid, smooth response, under automatic control, to a wide range of flow demands.

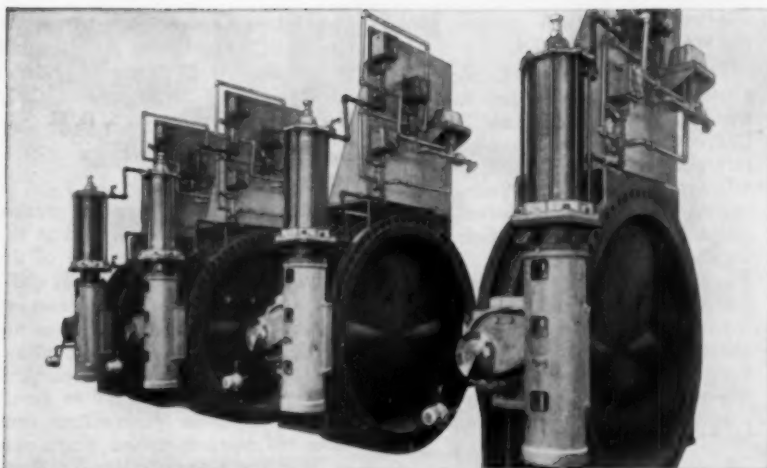
Adjustable-Blade Pumps will vary in output to meet the gradual changes in flow requirement as compared to stepped increments of flow and possible surges which would result if fixed-blade pumps had been installed.

Two of these pumps will operate when required to raise the hydraulic grade line and supply adequate raw water to two remotely located treatment stations. As demand increases, a third pump will be used. A fourth pump is available for standby service. Pump blade angles are controlled automatically by a positioner responsive to downstream hydraulic grade line.

A-1488



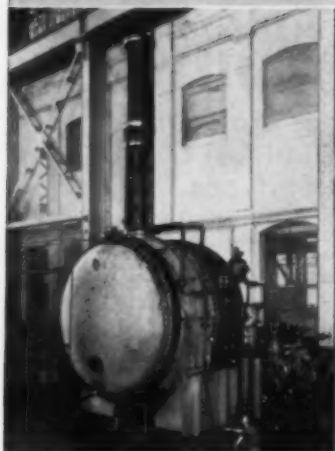
You may obtain full information on A-C Adjustable and Fixed-Blade High Capacity Axial Flow Pumps and Valves by writing to Allis-Chalmers, Hydraulic Division, York, Pennsylvania.



Four Allis-Chalmers 90-inch 50-16 fabricated steel butterfly valves used for pump check. These valves are equipped with the A-C full body rubber seat for dependable bubble-tight shut-off. Hydraulic cylinders, mounted on rugged crosshead mechanisms, provide smooth automatic operation.

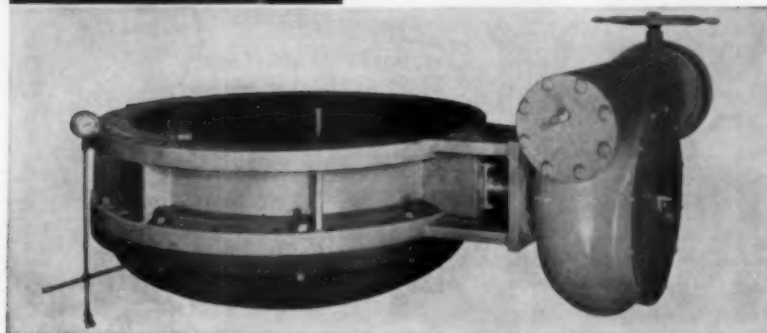


A-C adjustable-blade pump impellers are dynamically balanced after complete shop assembly and blade finishing.



Allis-Chalmers 144-inch Dow valve with fabricated steel body and hydraulic operator provides tight closure in both directions. When valve is open, flow bypasses pumps or is diverted to pump sumps when valve is closed.

One of four A-C 72-inch AWWA Class 50-16 fabricated steel butterfly valves used on pump suction. These valves are equipped with the A-C full body rubber seat and A-C manual operator. This valve is shown being tested with 50 psi air under water to insure bubble-tight shut-off.



SOIL MECHANICS & FOUNDATIONS

This is the second edition of a useful book first published ten years ago. It was written primarily for undergraduate civil and architectural students and also for practicing engineers who encounter soil problems in their everyday work. The science of soils engineering has been developing and this edition includes the newer concepts of bearing capacity and new material on drainage, classification, soil expansion, stability, anchored bulkheads and earth dam design. There are 10 chapters, including foundations, earth pressures, compaction and stabilization, stability of earth masses and underground investigations. An appendix gives brief information on 1960 unit costs. Well illustrated with pertinent and well prepared drawings; 378 pages; George B. Sowers, consulting engineer, Cleveland, and George F. Sowers, Professor of Civil Engineering, Georgia Institute of Technology. The Macmillan Co., 60 Fifth Ave., New York 11, N. Y. \$8.

THE CONSULTING ENGINEER

There has been needed for a long time a presentation of the professional and management problems involved in practicing engineering as a consultant. This book covers a good deal of material that many engineers starting in consulting work find out painfully. In a sense, it is a start in codifying many of the principles involved. As with most engineering texts, any adequate review, in the accepted sense of a book review is difficult or impossible; a resume of what is covered and the approach used may be better. Essentially, the text has two main parts. The first is concerned with the consulting engineer's relationships with his clients, other engineers and the public. The nine chapters in the section cover services performed, fees, engineering service contracts, selection of engineers and selling engineering services. The second part deals with the internal problems of a consulting office—organization, adminis-

tration, personnel, management and facilities. The text does not discuss or present technical engineering as it relates to design or construction. It is a management text. The author is C. Maxwell Stanley, The Stanley Engineering Co., Muscatine, Iowa, 236 pages, plus three appendices. \$5.95. John Wiley & Sons, Inc., 440 Park Ave., South, New York 16, N.Y.

TEXAS WATER & SANITATION AGENCIES

A directory of water and sanitation agencies in Texas as of 1960 has been prepared as a public service by the Texas Water & Sanitation Research Foundation. Listed for the more than 800 organizations (660 of which are agencies or subdivisions of the state) are the mailing address and name of at least one individual officer. The scope of activity is indicated in many cases. Included are state and federal executive and legislative agencies; water control and improvement districts; other special districts; and scientific societies and other associations with their committees and local sections. There are 52 pages in the directory. Copies are available at \$2.50 from Dr. Louis Koenig, Executive Secretary, 6702 Blanco Road, San Antonio, Texas.

COLLOIDAL BEHAVIOR and WATER SANITATION

The Rudolfs Research Conference, a tribute to the late William Rudolfs, was held last June at Rutgers University. The subject of the conference was the principles of colloidal behavior and their applications to water sanitation. Outstanding speakers—Drs. Schulman, La Mer, Smellie, White, Morris, Stumm and Black—discussed the various topics and applications. Mimeographed; 142 pages; \$2. Make checks payable to Rutgers University and mail to Miss B. Crenner, Secretary, Dept. of Sanitation, Rutgers University, New Brunswick, N. J.

COST ACCOUNTING FOR CONTRACTORS

A new publication "Suggested Guide for Field Cost Accounting for Building Contractors" presents sample annotated forms for the preparation of project estimates using a standard system, for recording job labor and material cost distributions, and for the preparation of cost reports which will give a realistic forecast of the job outcome as well as up-to-date and accurate figures for the bank and bonding company. The booklet was developed by a

special committee of the Associated General Contractors of America and is available at \$2.50 per copy from AGC National Headquarters, 1957 E St., NW, Washington 6, D. C.

PROFESSIONALISM IN ENGINEERING

This publication contains twelve outstanding papers delivered at the College-Industry Conference of the University of Cincinnati. It is difficult or impossible to abstract or review these, but many of them are worth study because of the attention paid to "professional climate" and the factors necessary to create it. The complete proceedings contain 104 mimeographed pages and cost \$5 from the College of Engineering, University of Cincinnati, Cincinnati, Ohio

REFUSE COLLECTION and DISPOSAL

This is an annotated bibliography covering material published in 1958 and 1959 on administrative and operational phases of refuse collection and disposal. This is Series 4, Supplement D. 48 pages. Prepared by Edward R. Williams, The Public Inquiries Branch, Office of Information, Public Health Service, Washington 25, D.C.

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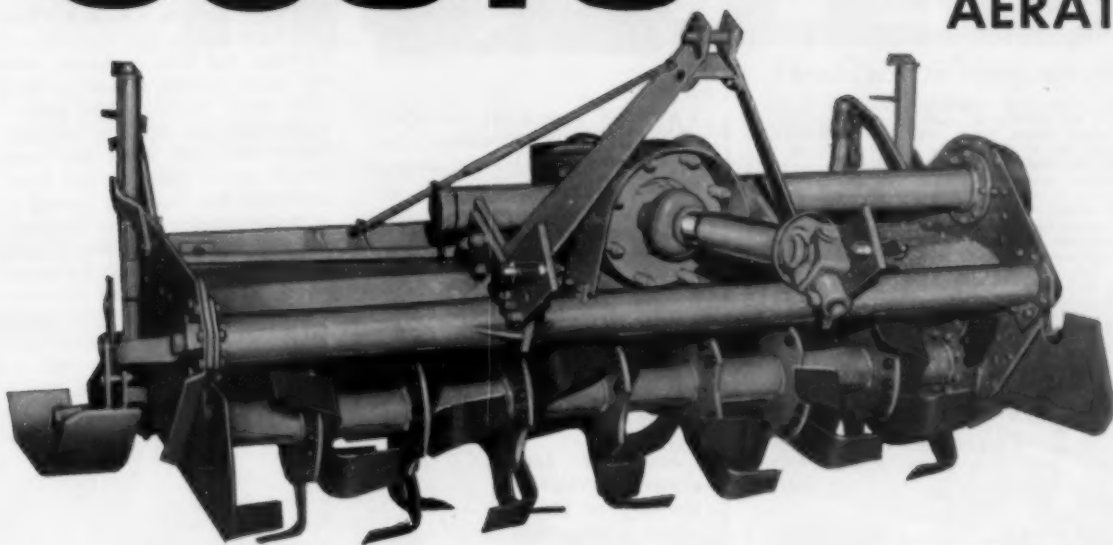
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About the Cover



Pic's, Inc.

WHEN completed, the Central District Filtration Plant in Chicago will be the largest water filtration plant in the world. The plant, which is now under construction, is described elsewhere in this issue.

The men who are responsible for the provision of pure water to the City of Chicago through the operation of water treatment facilities and other units of the Chicago water system are shown on the cover. They are:

James W. Jardine, Commissioner of Water and Sewers for the City of Chicago, is a registered professional engineer in Illinois. He has been with the City in various capacities since February, 1938, and was appointed Commissioner on January 1, 1953, upon the reorganization of the Department. Under his direction, the Chicago water works system, in the last eight years, has invested \$157 million on capital improvements, and the current Five-Year Program calls for an additional expenditure of \$104 million. He is a member of the APWA, the AWWA and the Western Society of Engineers.

W. W. DeBerard, Chief Water Engineer for the City of Chicago, was appointed to the position of City Engineer in 1941. Prior to this, Mr. DeBerard served as Western Editor of the *Engineering News-Record* and as Chief Engineer for the Chicago Regional Planning Association; he was also a member of the Engineering Board of Review for the Sanitary District of Chicago. Graduating from Beloit College in 1896 and from MIT in 1901, he was engaged in various engineering capacities on many water and sewage projects before coming to Chicago. He is an honorary member of the AWWA and the ASCE. He received the Fuller Award from the Illinois Section of the AWWA in 1954, and in 1960, was

the recipient of a citation from the American Association of Engineers to commemorate the golden anniversary of his professional engineering services in the City of Chicago.

H. H. Gerstein, Assistant Chief Water Engineer for the City of Chicago, has been employed with the water works system of that City since shortly after graduation from the Armour Institute. Since 1953, his work has been chiefly future planning and management. Mr. Gerstein served as a major in the Army Sanitary Corps during World War II, and following the war, was for seven years in charge of the operation of the then newly completed South District Filtration Plant. He is a life member of the AWWA, a fellow of the ASCE, and a member of the AASE. He received the Fuller Award of the Illinois Section of the AWWA in 1955 and the Management Division Award in 1957. He was National Director of the AWWA from 1957-60 and Chairman of the Illinois Section in 1941.

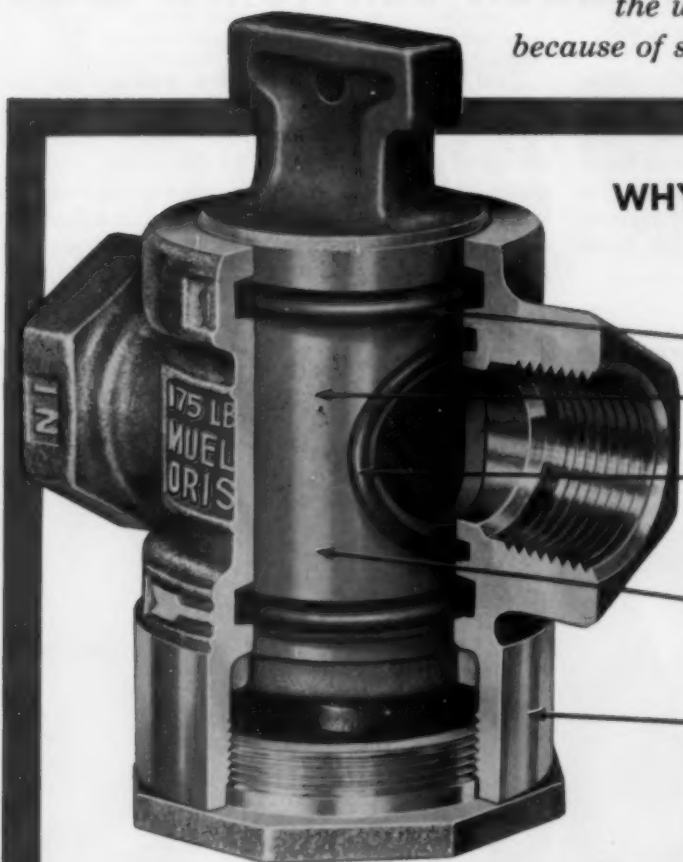
John R. Baylis, Engineer of Water Purification in charge of the operation and research for water treatment in Chicago, has world-wide renown as a filtration expert. He came to the City of Chicago in 1926 to operate the experimental filtration plant. The results of the studies made at this plant were incorporated in the design of the South District Filtration Plant, the largest plant now in existence, and also in the design of the Central District Filtration Plant, now under construction, which will be three times as large as the South District Filtration Plant. He is an honorary member of the AWWA which has honored him with the Goodell Award in 1932; the Fuller Award of the Illinois Section in 1939; and the Purification Award in 1957. He received the James Laurie Award of the ASCE and was twice awarded the Dexter Brackett medal by the NEWWA. He was graduated from Mississippi A & M in 1905; before being employed by the City of Chicago, he received national recognition for his work on filtration and corrosion control in the Baltimore, Md., and Jackson, Miss., water works.

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today recognized as the lifetime curb valve by
the water works industry
because of superior features!*



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Top and Bottom O-rings—provide positive pressure sealing without mechanical means.

Straight, Balanced Pressure Plug—O-rings of equal size at top and bottom eliminate end thrust, contribute to turning ease.

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Ford's tilt cabs permit quick access to the engine for lower-cost maintenance. Electrical circuit "printed" on back of instrument cluster eliminates the usual tangle of wires. Quick-disconnect, multiple-contact plugs in the wiring harness replace numerous individual connections to speed servicing and prevent errors. Ask your Ford Dealer for more information on these trucks designed especially for municipal work.

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You save from the start with Ford's traditionally low prices, and your savings continue with low operating and maintenance costs. These facts are documented by certified test reports from America's foremost independent automotive research firm. Ask to see these reports. They're on file at your Ford Dealer's.

In addition to these dollar-and-cents savings, the following bonus benefits are yours with Ford Trucks:

1. Rigid quality controls give you the strongest safeguard of truck reliability ever. Modern, *exclusive-truck* manufacturing facilities, with emphasis on quality every step of the way, are designed to give you a Ford Truck that is as free from defects as a truck can be. Tangible results of these high standards are Ford's new warranties.

2. Exclusive 100,000-mile warranty (or 24 months) on 401-, 477- and 534-cu. in. Super Duty V-8's is the most liberal in the industry. Each major engine part (including block, heads, crankshaft, valves, pistons, rings), when engine is used in normal service, is warranted by your dealer against defects in material or workmanship for 100,000 miles or 24 months, whichever comes first. The warranty covers full cost of replacement parts . . . full labor costs for first year or 50,000 miles, sliding percentage scale thereafter.

3. 12,000-mile warranty (or 12 months) on all 1961 Ford Trucks of every size is further evidence of the confidence

Ford has in its quality controls. Each part, except tires and tubes, is now warranted by your dealer against defects in material or workmanship for 12 months or 12,000 miles, whichever comes first. The warranty does not apply, of course, to normal maintenance service or to the replacement in normal maintenance of parts such as filters, spark plugs and ignition points.

4. Special fleet financing can be arranged by your Ford Dealer. It's available for owners of two or more trucks, and provides the opportunity to precisely tailor payments to your income patterns or depreciation schedules. This fleet-fitted financing offers substantial savings and frees your working capital.

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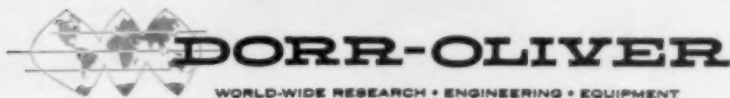
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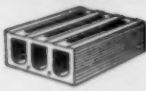


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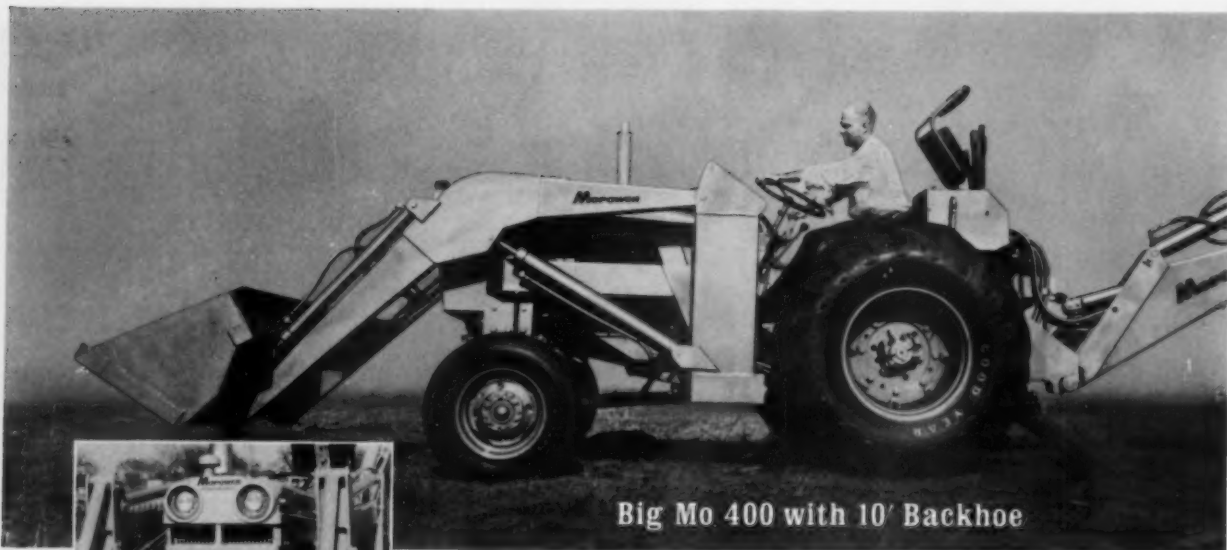
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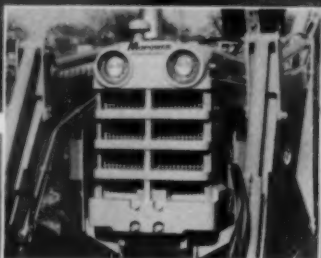
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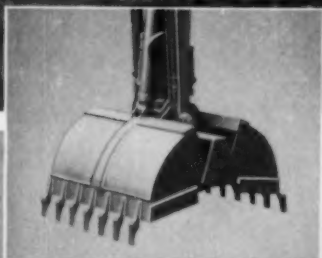
Big Mo 400 with 10' Backhoe



Big Mo 500's new, 400-lbs.-heavier front end ... exclusive new $\frac{3}{4}$ yd. loader!



Big Mo 500 with 13' Backhoe



New Mopower Hydro-Clam ... available on the 13' and 15' backhoes!



Big Mo 500 with 15' Backhoe



PICK YOUR DEPTH... 10, 13, 15 FEET!

Only the new line of Big Mo's give you this choice of backhoes... plus exclusive new $\frac{3}{8}$ yard loaders, new 400-lbs.-heavier front ends!



Now, new Mopower *flexibility*! The Big Mo 500 available with 13' or 15' backhoe! The Big Mo 400 with 10' or 13' backhoe!

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These new advances, along with the 500's no-clutching shuttle reverse and its powerful Motec-built engine, give it the muscle and mobility needed for your toughest jobs.

The new Big Mo 400 is no lightweight, either. Its new, heavy duty front axle is 226 pounds heavier for better balance in backhoe work. The loader holds $\frac{5}{8}$ ths of a yd. *struck*. And remember, the 400 is available with a 10' or a 13' backhoe. In addition, it has the same rugged Motec-built engine as its big brother, the 500. And the low-priced 400 is available *without* the backhoe or loader... for mowing, drawbar work, *wherever* you can put this versatile wheeler to work.

Check *all* the features of the new Big Mo 500 and 400 at your Mopower dealer's today. Then, *pick the muscles to match your jobs!*



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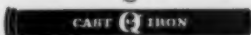


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1

Insert the gasket in its seat in the socket. Forming gasket loop helps initial stage of seating. Release of loop allows gasket to spring into the gasket seat where it is securely held.



2

Apply special Usiflex lubricant to the ball and inside surface of seated gasket in socket. After lubrication, ball is ready to be pushed into socket.



3

Ball has been socketed. Retainer ring lugs have been lined up with recesses in bell and retainer ring is ready to be moved into the bell and rotated.



4

After insertion and rotation of retainer ring in bell, the lugs on retainer ring are in back of and in register with internal flange segments in bell. Lead lock is partially inserted into recess between the bell and retainer ring.



5

Lead lock completely inserted in recess is being caulked in place by hammer blows on a wide caulking iron.



Get all-job economy and top performance with New John Deere 2010 Wheel Power



Now reporting for duty on earthmoving and construction jobs of all kinds, new John Deere "2010" Wheel Units provide the advantages of 52-engine-horsepower performance at remarkably low cost. New productive power is combined with high maneuverability and full operator comfort to insure top work capacity on any assignment. Heavy-duty design throughout provides the kind of day-after-day dependability required to hold maintenance costs down, keep projects on schedule.

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A wide choice of power-matched John Deere Landscape Equipment provides start-to-finish efficiency. Disks, rippers, rear blades, a landscape rake, scarifier-scraper combination and landscape seeder provide full versatility. Flail mower also available.

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NEW LISTINGS

Push-Type Cast Iron Pipe Joint

22. New brochure describes and illustrates pipe with this important development known as American "Fastite" joint. Offered as a superior double-sealing single gasket type of joint. Book also contains full specifications. Address American Cast Iron Pipe Co., P. O. Box 2603, Birmingham, Ala., or check our reply card.

To Measure Moisture Content and Density



28. Engineers will find in this 12-page booklet invaluable information on necessities, methods and instruments involved. To get your free copy just ask for "Moisture-Density Determinations" brochure direct from Testlab Corp., 3398 Milwaukee Ave., Chicago 41, Ill., or by using our time-

saving reply card.

Aluminum Traffic Control Devices

32. Is title of 24-page booklet covering every such device made of aluminum, from signs and sign blanks to panels, overhead structures and paint. Full specifications. For yours, just write Aluminum Co. of America, Alcoa Bldg., Pittsburgh 19, Pa., or use reply card.

Table Feeder for Dry Chemicals

36. New bulletin gives data on suitable feeding for practically any granular or powdered dry material. This portable lightweight Table Feeder is fully described in 4-page brochure 23-02.20-1 available from B-I-F Industries, P. O. Box 276, Providence 1, R. I., or by checking our card-number.

Specification Sheets on

Latest Highway Equipment

56. Describes equipment for compacting, also scrapers and distributors. Specify sheets wanted, direct to Seaman Corp., Seaman-Gunnison Div., Milwaukee, Wis., or use our reply card.

A New Plastic Pipe

60. . . . produced by Johns-Manville and described in a just-out 4-page brochure. Shows various applications with tabular data on pressures, sizes, weights. Ask for TR-273A from Johns-Manville, 22 East 40th St., New York 16, N. Y., or circle our card-number.

New Street and Highway

Lighting Luminaires

66. Attractive brochure describes new 750- and 1,000-watt mercury-lamp lighting luminaire Type OV-50. Tells where it should be applied as well as some of the characteristics of the luminaire. Get this latest word on lighting by writing for Booklet SA-8869 to Westinghouse Lighting Div., Edgewater Park, Cleveland, Ohio, or check our card-number.

Electric Submersible Pumps

73. Beautiful new full-color illustrated booklet describes most of the pumps in the FLYGT line. Just ask for "Black Magic" brochure from Flygt Corp., Hoosick Falls, N. Y., or use our reply card.

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field of cities, counties or states.

Road Rollers for Rent

81. Full details of the plan offered by well-known manufacturer of rollers are in handy little folder. Permits you to "roll without owning." Write for booklet DM-37 to Galion Iron Works & Mfg. Co., Galion, Ohio, or check our card-number.

How to Stop

Bothersome Dust

90. A pocket-size booklet gives answers to this common problem. Lists places where calcium chloride can help. Includes some unique ones that may especially interest you. Write for booklet by name, as above, to Wyandotte Chemicals Corp., Wyandotte, Mich., or circle our card-number.

Power Sweepers for Cramped Quarters

91. How to gain the advantages and economies of power sweeping in numerous common smaller areas is the subject of these color-illustrated descriptive sheets. Ask for Bulletins 703-4-5- and 6 direct of Wayne Mfg. Co., 1201 E. Lexington St., Pomona, Calif., or just check our card-number.

How Cushman Trucksters Save

on Parking Meter Patrols

96. 12-page illustrated booklet gives actual interviews with users relating their experience and giving detailed cost-breakdowns. Write for "Cost Analysis" booklet to Cushman Motors, Lincoln, Neb., or use our reply-card.

Vacuum—A New Method of Pavement

Sanitation

103. New folder describes a compact, maneuverable pavement cleaner using only vacuum-air blast air. Sweeps path 6½ feet wide. Complete details available from Tarrant Mfg. Co., 28 Jumel Place, Saratoga Springs, N. Y., or just check our card-number.

Readers Service Index

New Catalogs	pages 34 & 36
Odor Control	page 36
Water	pages 40, 41, 42 & 44
Business	page 44
Sewerage & Waste	pages 46 & 48
Lighting & Traffic	page 48
Refuse	page 52
Weed Control	page 52
Construction	page 54
Streets & Highways	page 56

Prestressed Concrete Information

97. A complete profusely illustrated catalog covering use of prestressed concrete as a construction material for bridges, pressure pipe, tanks, and many other public works applications. Gives specifying data, too. Address American Steel & Wire Div., U. S. Steel Corp., Rockefeller Bldg., Cleveland 13, Ohio, or check our card.

A Low Cost Answer for Mixing and Pulverizing Jobs

99. Condensed into four informative pages is illustrated data on this tractor-power take-off soil blender, unusually versatile for many public work uses. Ask for Howard Unimix folder form 263 from Industrial Div., Howard Rotavator Co., Harvard, Ill., or circle our card-number.

Pressure Creosoted Timber in Modern Highways

125. 16-page well-illustrated booklet on many uses of creosoted timber, for bridges, posts, poles, guard rails, culverts and roadside park structures. You can well find it valuable. Write for it by above title to Plastics and Coal Chemical Div., Allied Chemical, 40 Rector St., New York 6, N. Y., or circle our card-number.

Packaged Pump Stations

126. Technical details on complete stations, graphically described and well illustrated to give you a quick grasp of their essential features. Write for Bulletin TQ-61 to Tex-Vit Mfg. Co., Box 117, Mineral Wells, Texas, or check our card-number.

A Novel Catch Basin Cleaner

127. Bulletin just out describes new one-man push-button remote controlled operation for cleaning deep catch basins in a few minutes. Other unique features. Write for Bulletin V-2 to Central Engineering Co., Inc., 4429 W. State St., Milwaukee 8, Wis., or use our reply card.

A Primer of Pneumatic Compaction

129. 16-page well illustrated booklet gives engineering theory behind pneumatic compaction as well as tips on how best to obtain maximum compaction, and data on new AMPAC-4 pneumatic compactor. Get the whole story easily by asking for Bulletin #410 from American-Marietta Co., Construction Equipment Div., Milwaukee 1, Wis., or check number on our card.

Diamond Masonry Bits

135. How to cut your masonry drilling costs, and with what bits, is the subject of 4-page fact-filled folder that points the way to doing better jobs by using proper equipment. Address Sprague & Henwood, 221 W. Olive St., Scranton, Pa. or use reply card.

License Bonds Booklet

140. The purpose and functions of license bonds and the protection they afford the public and government bodies are discussed in a 24-page booklet just released. Write Surety Association of America, 60 John St., New York 38, or circle our card-number.

Drop That Tree Where You Want It!

146. Here is a new device to control direction of fall, in close quarters or elsewhere. Saves labor and climbing and money. Get folders on the Trot directional tree faller, and accessory for straightening leaning utility poles, from Idaho Northwoods Co., P. O. Drawer 391, Sandpoint, Idaho, or use our reply card.

Helping to keep
a river clean...

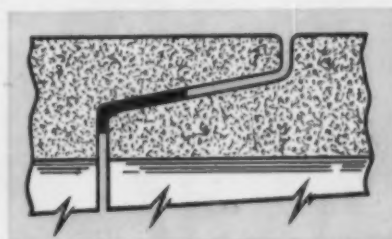
HAMILTON KENT
TYLOX
Rubber
PIPE GASKETS



**PREVENT JOINT LEAKS, WHIP CORROSION AND SPEED
PIPE WORK ON SEWER PROJECT AT OIL CITY, PA.***

Oil Creek, a watercourse in Oil City, Pa., will be cleaner, purer, and an even greater enhancement to the beauty of the city, as a result of current work being done under Oil City's continuing sewer expansion program. Consisting of several miles of new laterals, new concrete pipe interceptors up to 36" in diameter, and a new sewage treatment plant, the facilities now being added make it possible to treat all sewage waste disposal before effluent is discharged into the river.

Engineers and officials specified Hamilton Kent TYLOX Rubber Gaskets for coupling the pipe lines, knowing they could count on TYLOX for three important advantages: leak-proof joints to keep infiltration loads negligible at the new plant; acid-resistance to prevent deterioration of the joints and necessity of future repairs; and easier, faster pipe coupling, to help keep construction costs down.



TYLOX Gaskets form a permanently tight **compression seal**. Water can't leak in or out... roots and sediment can't penetrate... acids can't destroy. Pipe can be coupled in wet trenches... backfill may be applied immediately.

5099

**WRITE FOR ENGINEERING DETAILS ON TYLOX—
Specify TYLOX FOR YOUR PIPE PROJECTS**

* **PROJECT:** Sanitary sewer expansion, Oil City, Pa.

ENGINEERS: Morris Knowles, Inc., Consultants, Pittsburgh, Pa.,
R. B. Fleming, Resident Engineer.

CONTRACTOR: Ben Construction Co., Pittsburgh, Pa.

PIPE: Reinforced concrete, manufactured by Concrete Pipe Co.
of Ohio, Cleveland, Ohio.

HAMILTON KENT
MANUFACTURING COMPANY
KENT, OHIO

427 West Grant Street

Orchard 3-9555

To order these helpful booklets check the reply card opposite page 34.

NEW LISTINGS (Cont.)

Soil Saver

Curb Highway Banks Erosion

145. . . . with jute mesh. Folder describes an ideal answer to highway erosion and washout problems. Acts as mulch for seeded areas. Simple and sure method and material illustrated graphically. Ask for "Soil Saver" folder, from Ludlow Textile Products, Needham Heights 94, Mass., or check reply card.

Kills Aquatic Weeds

but Not Fish

156. A handy folder tells all about Penco Aquathol to kill weeds around lakes, water-fronts, fish ponds, etc. Destroys underwater weeds, floating weeds and algae fast. Ask for Aquathol folder, direct from Agricultural Chemicals Div., Pennsalt Chemicals Corp., 2901 Taylor Way, Tacoma, Wash., or check our card.

Air Pollution Control

147. A thoughtful 20-page booklet filled with frank discussion of what air pollution costs us all, and where the responsibility for its cure can best be placed. Address John Wood Co., Air Pollution Control Division, Florham Park, N. J., or use reply card.

New Street Sweeper Broom Filament

157. Keystrand is its name, and full description of its contribution to better street sweeping is given in folder that also contains a sample of this new polypropylene filament. Write to Keystone Plastics Inc., 280 Badger Ave., Newark 6, N. J., for yours, or check our card-number.

Vacuum Up Your Highway Litter!

163. New 4-page illustrated folder gives the attractive details of how you can keep roadsides and other areas clean of leaves and litter. Works eight times as fast as hand labor. Address Giant-Vac Mfg. Co., South Willington, Conn., or use reply card.

Defer Old Age in Your Sweeper Brushes

170. Write for literature on big savings through decreased sweeper broom wear made possible with use of Sanfax 299. Saves time and water, too. Address Sanfax Corp., Box 604, Atlanta, Ga. or check number on our card.

A Big Help for Slurry Sealing

175. Catalog available on this new 4,000-yards-per-hour machine, of continuous mix type. New features that you will want are described. Address The Young Co., 200 Mill St., Waco, Texas, or use our reply card.

One Locator

Does Two Jobs

177. Transistorized "Dualtronic" Model LC-5T either pin-points detection of pipe, cables, mains, etc. or becomes a leak detector by plugging in a special microphone. To get all the facts write The Goldak Co., Inc., 1545 W. Glenoaks Blvd., Glendale 1, Calif., or check the inquiry card.

Insect Control and Soil

Stabilization with One Unit?

191. Yes, if it's a Buffalo Turbine sprayer-duster that is used for dry or wet insecticides and finds application also in sand, dust and soil stabilization with lignin sulfonate. Several popular models, trailer or skid mounted, are described in literature of Buffalo Turbine Agricultural Equipment Co., Inc., Gowanda, N. Y. Check reply card for your copies.

For Prompt Service Use The Reply Card

Don't Haul and Burn Brush, Dispose of It on the Spot

196. How you can do this the easiest way with Fitchburg Chippers is the theme of 16-page illustrated catalog that can save you work and grief. Gives experiences of others and describes simple mounting on truck body or on trailer, tractor or Jeep. Write Fitchburg Engineering Corp., Fitchburg, Mass., or just use reply card.

Adjustable-Blade Pumps for Booster Water Pumping

197. Full information on Adjustable and Fixed Blade high capacity axial flow pumps and valves is yours just by writing to Allis-Chalmers, Hydraulic Div., York, Pa., or by ringing the number on our card.

For Perfect Water Level Control

200. Regardless of the size of your elevated tank find out what is offered you in cushioned altitude control valves. Write for Bulletin W-4B to Golden Anderson Valve Specialty Co., 1244 Ridge Ave., Pittsburgh 33, Pa., or circle number on card.

Volumetric Dry Feeders

202. Bulletin gives full details on operating and design features. For valuable technical data on them write for Catalog No. 320.130 from Wallace & Tiernan Inc., 25 Main St., Belleville 9, N. J., or use our reply card.

Pipe Cutters for All Pipe

204. Illustrated sheet shows Wheeler cutters for each kind of pipe, with descriptions and specifications. For yours write The Wheeler Mfg. Corp., P. O. Box 688, Ashtabula, Ohio, or check our card-number.

ODOR CONTROL

Don't Cover Up Odors, Kill Them

597. New information sheet available that tells what Sani-Septic concentrate can do in roadside, parks and rest areas to render them inoffensive. For your helpful copy just write Werley Chemical & Supply Co., 1505 Broadway, Cleveland 15, Ohio, or check number on card.

(More listings on page 40)

PUBLIC WORKS for June, 1961



Perfect WATER LEVEL CONTROL G-A CUSHIONED ALTITUDE CONTROL VALVE

Regardless of the size of the elevated tank, the Golden Anderson Altitude Control Valve automatically maintains a constant water level and prevents overflow. Available in sizes 2" to 36", this valve is normally housed in an underground pit to protect from inclement weather.

Bulletin W-4B has complete technical data.

**GOLDEN
ANDERSON**
Valve Specialty Company

1244 RIDGE AVENUE, PITTSBURGH 33, PA.

Designers and Manufacturers of VALVES FOR AUTOMATION

A-M CONCRETE PIPE

*tailored to the fill—
to save you money!*

HI-HED

ROUND

LO-HED

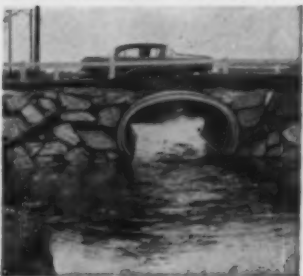
FOR HIGHEST FILLS AND HEAVY LOADS, Hi-Hed® is the *most economical* permanent sewer and culvert pipe because it is designed for minimum vertical load and maximum lateral support.



FOR AVERAGE FILLS, round concrete pipe is the *most economical* permanent conduit and American-Marietta saves added dollars through nationwide technical and manufacturing services.



FOR LOW FILLS, Lo-Hed® is the *most economical* permanent pipe because it offers maximum capacity under minimum cover and has inherent strength for greater resistance to impact.



AMERICAN-MARIETTA COMPANY
CONCRETE PRODUCTS DIVISION

GENERAL OFFICES:
AMERICAN-MARIETTA BUILDING

101 EAST ONTARIO STREET, CHICAGO 11, ILLINOIS, PHONE: WHITENALL 4-5600

CAST IRON PRESSURE PIPE

Has Served a Century or More in These 112 CITIES

WATER UTILITIES

1816 Allentown, Pennsylvania
1816 Montreal, Quebec
1819 Philadelphia, Pennsylvania
1824 New York, New York
1826 Winchester, Virginia
1827 Wilmington, Delaware
1829 Columbia, Pennsylvania
1830 Detroit, Michigan
1830 Lynchburg, Virginia
1830 Mobile, Alabama
1830 Richmond, Virginia
1831 Baltimore, Maryland
1831 St. Louis, Missouri
1832 Nashville, Tennessee
1834 Pottsville, Pennsylvania
1834 Reading, Pennsylvania
1834 Wheeling, West Virginia
1835 Lancaster, Pennsylvania
1836 Huntsville, Alabama
1840 York, Pennsylvania
1842 Winston-Salem, N. C.
1844 Frederick, Maryland
1844 St. John, New Brunswick

Prior to
1845 Troy, New York
1845 Zanesville, Ohio
1846 Halifax, Nova Scotia
1847 Boston, Massachusetts
1847 Mount Holly, New Jersey
1848 Hartford, Connecticut
1849 Utica, New York
1850 Honolulu, Hawaii

Prior to
1850 Pittsburgh, Pennsylvania
1851 Albany, New York
1851 Alexandria, Virginia
1852 Buffalo, New York
1853 Chicago, Illinois
1852 Syracuse, New York
1854 Nashua, New Hampshire
1854 Newburgh, New York
1854 Northampton, Pa.

Prior to
1854 Sacramento, California

Prior to
1855 Cambridge, Massachusetts
1855 Minersville, Pennsylvania
1855 Williamsport, Pa.
1856 Cleveland, Ohio
1856 Petersburg, Virginia
1858 Washington, D. C.
1859 San Francisco, California

GAS UTILITIES

1816 Baltimore, Maryland
1823 Boston, Massachusetts
1830 Fredericksburg, Virginia
1832 Mobile, Alabama
1835 New Orleans, Louisiana
1835 Philadelphia, Pennsylvania
1838 Charleston, S. Carolina
1839 Louisville, Kentucky
1842 Toronto, Ontario
1845 Cincinnati, Ohio
1845 Painesville, Ohio
1846 Newark, New Jersey
1847 New Haven, Connecticut
1847 Fall River, Massachusetts
1847 Quebec, Quebec
1848 Savannah, Georgia
1849 Hartford, Connecticut

Prior to
1848 Montreal, Quebec
1850 Salem, Massachusetts
1851 Bridgeport, Connecticut
1851 Chicago, Illinois
1851 Indianapolis, Indiana
1851 Madison, Indiana
1851 New Brunswick, N. J.
1851 Richmond, Virginia
1852 Bangor, Maine
1852 Bound Brook, New Jersey

1852 Frederick, Maryland
1852 Norristown, Pennsylvania
1852 Providence, Rhode Island
1852 West Chester, Pa.
1853 Detroit, Michigan
1853 Elizabeth, New Jersey
1853 Peoria, Illinois
1853 Plymouth, Massachusetts
1853 Springfield, Illinois
1853 Rochester, New York
1854 Bethlehem, Pennsylvania
1854 Evansville, Indiana
1854 Hagerstown, Maryland
1854 Knoxville, Tennessee
1854 Nantucket, Massachusetts
1854 Norwich, Connecticut
1855 Atlanta, Georgia
1855 Ottawa, Ontario
1855 Sandusky, Ohio
1856 Adrian, Michigan
1856 Catawissa, Pennsylvania
1856 Chambersburg, Pa.
1856 Media, Pennsylvania
1857 Alton, Illinois

Prior to
1857 Carlisle, Pennsylvania
1857 Charlottesville, Virginia

Prior to
1857 Harrisburg, Pennsylvania
1857 Huntingdon, Pennsylvania
1857 Lambertville, New Jersey

Prior to
1857 New York, New York

Prior to
1857 Poughkeepsie, New York
1858 Natchez, Mississippi
1858 Raleigh, North Carolina

Prior to
1858 Vicksburg, Mississippi

Prior to
1858 Washington, D. C.
1858 Hannibal, Missouri

Prior to
1859 Lewisburg, Pennsylvania



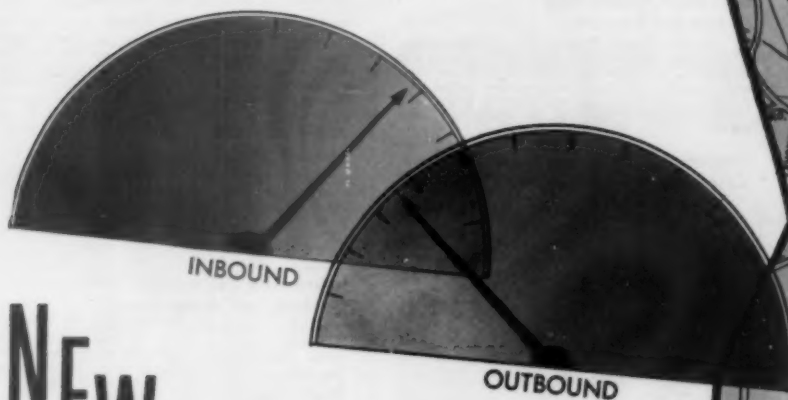
No substitute pipe has ever matched this record of long-lived, trouble-free service. Keep this in mind when you select pipe for your water mains or gas lines.

This advertisement is published
in the interests of the
Cast Iron Pressure Pipe Industry
by



WOODWARD IRON COMPANY

WOODWARD, ALABAMA



NEW TM SYSTEM

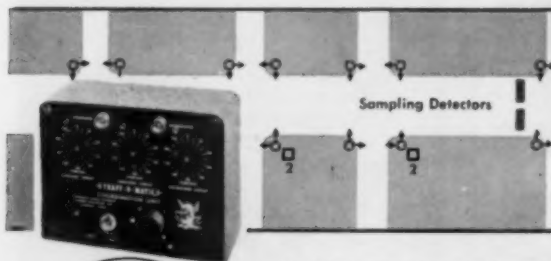
provides traffic-actuated signal control for arterial flow . . . automatically . . . for less money

The TRAFF-O-MATIC® TM SYSTEM is a traffic-actuated, 3-offset, 3-cycle length system that provides a low cost method of arterial signal control. It responds to actual traffic changes without time clocks . . . without program drums.

Continuously and automatically the TM System seeks and selects the most favorable offset and cycle length combination based on the relative volume levels of two sampled directions of traffic flow. Operating adjustments are made without tools. Circuitry and component construction incorporate the latest design techniques for maximum service and ease of maintenance.

1 ■ TRAFF-O-MATIC MASTER MODEL TM-1 maintains continuous inbound-outbound volume comparison . . . automatically selects one of three offsets to best serve traffic flow, in addition to free operation at low volumes.

2 □ TRAFF-O-MATIC COORDINATING UNIT MODEL TM-21, one with each local semi-actuated controller, interprets Master's offset instructions . . . easy knob adjustment of three offsets . . . each offset can be assigned an individual background cycle length.



WRITE TODAY FOR DETAILS

AUTOMATIC SIGNAL DIVISION

EASTERN INDUSTRIES, INCORPORATED
NORWALK, CONNECTICUT



To order these helpful booklets check the reply card opposite page 34.

WATER WORKS

Handbook of Cast Iron Pipes and Fittings

52. Full engineering data on products of the Alabama Pipe Co., including Super De-Lavault cast iron pressure pipe and pipe fittings, valve boxes and other municipal castings are provided in Pressure Pipe Catalog No. 54, a 196-page publication of Alabama Pipe Co., Anniston, Ala. Weights, dimensions and specifications are clearly indicated in this easy to use in reference.

Propeller Meters For Dependable Water Metering Control

53. The complete line of Measure-Rite propeller meters are described in Bulletin MR-105 available from Measure-Rite, Inc., 4545 W. Brown Deer Rd., Milwaukee 23, Wis. Check the card for details on these accurate meters.

New Ring-Tite Joints on Valves and Hydrants

61. . . . are described and illustrated in new folder, for use with Transite pressure pipe. Tells how these joints eliminate need for special fittings with attendant extra labor and materials. Write for Bulletin RT-53 to The A. P. Smith Mfg. Co., 545 No. Arlington Ave., East Orange, N. J., or just circle number on card.

How to Select Right Angle Drives

62. Data-filled Catalog 31 & 32 of Johnson Gear & Mfg. Co., Ltd., 8th & Parker Sts., Berkeley 10, Calif., makes it easy to select the correct right-angle gear drive for deep well turbine and other vertical shaft pumps. Includes details on the Johnson "Redi-Torq" gear drive. To get your copy just check the reply card.

Catalog on Synchronous Motors and Controls

64. A 27-page Catalog B-7292 on synchronous motors and controls is well illustrated and contains motor selector charts, application data, and formulas for calculating power factor. For a copy write Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa., or check the reply card.

Convenient Reference Manual Covers Cast Iron Pipe, Valves and Hydrants

76. An 80-page manual, issued by R. D. Wood Co., Independence Sq., Philadelphia 5, Pa., presents specifications for "Sand-Soun" cast iron pipe and fittings, outlines types of joints available, lists dimensions and weights in convenient tables and includes, in addition, full engineering data on the Mathews and R. D. Wood fire hydrant and R. D. Wood gate valves.

Use The Reply Card

What You Should Know About Venturi Tubes and Nozzles

105. Bulletin No. 100 contains a short description of the various types of Venturi tubes used for water, sewage or sludge service. This is a condensed bulletin which should be in the files of all consulting and designing engineers involved in water and sewage works design. Write Simplex Valve and Meter Co., 7 East Orange St., Lancaster, Pa. or check the reply card.

Controlling Water in Masonry

101. . . . confronts and puzzles practically every building owner, designer or builder. There is still no "wonder drug" cure-all, but a very valuable 44-page booklet is available that goes farther in diagnosis and suggested remedies than anything we have yet seen. Your copy of "Walls Breathe" can be had from Western Waterproofing Co., 1223 Syndicate Trust Bldg., St. Louis 1, Mo.

Stationary Engines For Sewage and Water Treatment Plants

82. Engines that operate on sewage gas, gasoline, butane or natural gas are described in literature from Climax Engine Mfg. Co., Div. of Waukesha Motor Co., Clinton, Iowa. Check the reply card.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

Information on Service, Valve, Roadway and Meter Boxes

122. Literature on specifications covering "Buffalo" service, valve, roadway and meter boxes, and adjustable valve boxes for water and gas has just been released from Buffalo Pipe & Foundry Corp., Box 35-Station B, Buffalo 7, N. Y. Check the reply card for your information on these valve boxes.

Water and Sewage Plants

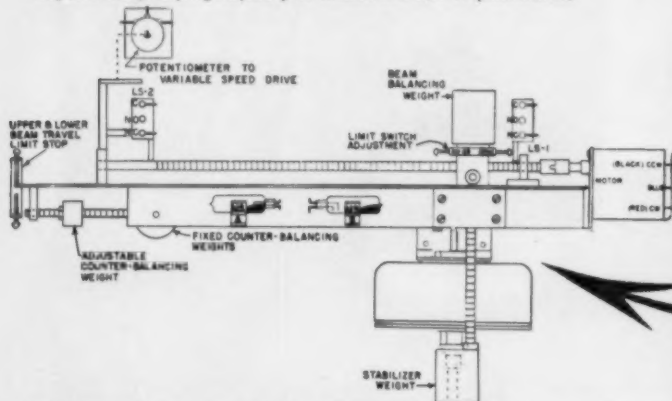
167. Engines are four-cycle, 6 or 8 cylinder, in-line models, ranging from 190 to 2150 bhp and from 135 to 1500 KW, are available either naturally aspirated or supercharged, and can be furnished to run as diesel, dual-fuel or gas engines. For Bulletin #115A check the reply card or write White Diesel Engine Div., The White Motor Co., Springfield, Ohio.

A Comprehensive Handbook on Water Meter Settings

174. "The Engineering of Water Meter Settings" contains 34 pages of clearly illustrated data and specifications to help improve your practices and simplify your work. Every Water Department should have a copy of this valuable reference book. To get your address Ford Meter Box Co., Inc., Wabash, Indiana, or use the inquiry card.

New Balance-Beam Control for Variable Speed Pumps

Healy-Ruff's new Serv-trol uses the balance-beam principle to match pumping speed to system requirements. Any change in system pressure or liquid level upsets the balance, and repositions a pilot potentiometer. The potentiometer, through a servo mechanism and pump controller adjusts the pumping capacity to match the new requirements.

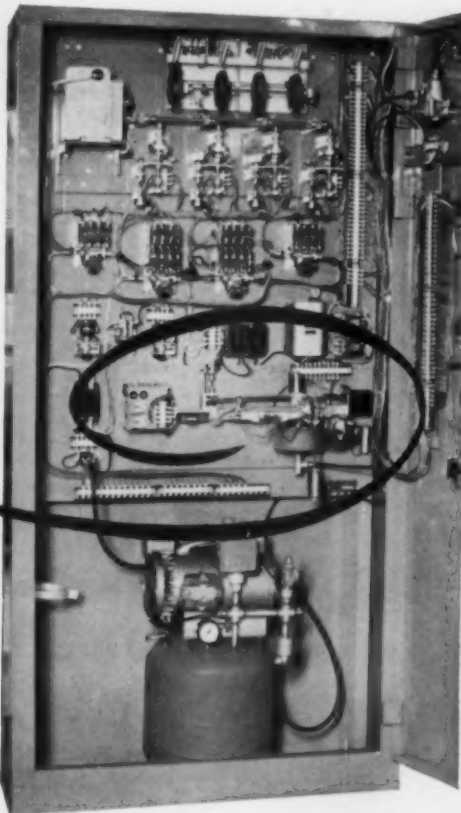


The balance-beam sensor is automatically set at the new balance position after each change in conditions. It is equipped with anti-hunting and over-travel devices. It works on either liquid level or system pressure sensing and can include indicators or recorders. For full details, write for Serv-trol Bulletin.

HEALY-RUFF COMPANY

791 Hampden Avenue, St. Paul 14, Minnesota

First in dependable controls for water works and sewage—since 1929



The Design and Function of Elevated Steel Water Tanks

179. A 20-page bulletin of engineering information with illustrations of typical installations, emphasizing ellipsoidal, radial cone and spheroidal designs, may be obtained by writing Chicago Bridge and Iron Co., Advertising Dept., 332 South Michigan Ave., Chicago 4, Ill. or by checking the reply card.

Lay Water Mains Faster With "Fluid-Tite" Couplings

184. Get permanent water-tight joints automatically with K & M "Fluid-Tite" couplings for K & M asbestos-cement pressure pipe. Full details on this faster installation and self-energizing couplings are available from Keesbey & Mattison Co., Ambler, Penna.

Design of Prestressed Concrete Tanks

194. An 8-page technical Bulletin, T-19, on the Design of Prestressed Concrete Tanks, gives engineering data and formulas of general interest to anyone considering prestressed concrete for storage tanks. Check the reply card or Write to The Prelod Co., Inc., 355 Lexington Ave., New York 1, N. Y.

Data Book For Engineers

199. New Link-Belt Catalog (No. 2617) includes all recent additions to their Water Sewage and Industrial Waste treatment equipment. All designing engineers will want this one. Write Link-Belt Co., Colmar, Pa., or use the card.

Manual on Filter Bed Agitators

206. General information-specifications and installation data regarding the application of Palmer agitators, or rotary surface wash in vertical and horizontal pressure filters—round, square and rectangular open gravity type filters are covered in Manual from Palmer Filter Equipment Co., 822 East 8th St., P. O. Box 1696, Erie, Penna. Check the reply card.

Bell and Spigot Joint Leaks Quickly Repaired

214. Broken water main can quickly be repaired when you have "Skinner-Seal" Split Coupling Clamps on hand. Leaky bell and spigot joints are made lastingly tight with Skinner-Seal Bell Joint Clamps. Get Skinner Catalog GW now—this handsome 48-page book shows how to make every type of pipe repair and covers a complete line of clamps to do the job quickly and easily. M. B. Skinner & Co., South Bend 21, Ind.

Paints For Bridges, Water Tanks & Other Metal Structures

258. Flake silica graphite paints for outdoor metals are described fully in literature from Paint Sales Div., Joseph Dixon Crucible Co., Jersey City 3, N. J. Check the reply card for details on these primer and protective paints.

A Quick Comparison of Water Meters Helps

274. That is the purpose of the new bulletin describing the newest accomplishments in water meter design and manufacture. With it comes a Condensed Catalog of the Rockwell line. Ask for Bulletin No. W-811 from Rockwell Mfg. Co., Municipal & Utility Div., 490 N. Lexington Ave., Pittsburgh 8, Pa.

Water, People and Hydrodynamics

302. . . . is the title of an illuminating booklet dealing with the world-wide problem of how to get water in adequate supply, when and where needed. Your copy can be had for the asking of Fairbanks, Morse & Co., 600 So. Michigan Ave., Chicago 5, Ill.

Learn About Positive and Easy Valve Operation

304. "LimiTorque" Valve Operators provide push-button control that enables one man to open and close any type of valve quickly and dependably, provide full protection from damage during closing cycle due to torque limiting mechanism. LimiTorque is available for operation by any power source and is readily adaptable to all types of remote control. Catalog L-550 completely describes and illustrates operation and installation. Philadelphia Gear Corp., King of Prussia, Penn.

NEW FROM LYLE

National Sign Service Helps You Select Signs and Accessories by Function



The function of a sign is very simple: to be seen and obeyed. But selecting the *most functional* sign for a given street or traffic problem is often more complicated.

That's why Lyle's National Signing Service can be of real value to you. Thousands of city, town, county and governmental officials have welcomed Lyle Field Representatives for their helpful advice and service.

Actually, in the past 45 years,

Lyle representatives have worked with hundreds of different sign problems—perhaps, the very one that confronts you now. Proper sign materials, applicable national and state sign standards . . . these and the many other considerations so vital to the field of traffic control.

And, of course, a conference with a Lyle Field Representative puts you under no obligation.

THE FUNCTION



TRAFFIC



PARKING



DIRECTIONAL



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To order these helpful booklets check the reply card opposite page 34.

Clow Bell-Tite Cast Iron Pipe

280. Laying water mains is easier, faster and more economical with Clow Bell-Tite joint cast iron pipe. Joint employs a single rubber gasket as the only accessory. Complete details available in illustrated literature from James B. Clow & Sons, Inc., P. O. Box 6600-A, Chicago 80, Ill., or check the reply card.

Use The Reply Card

Do You Know the Value of the V-Notch?

295. A new booklet tells what you want to know about how chlorine feeding can be made as regular and precise as the sunrise. Ask for "The V-Notch Story" direct of Wallace & Tiernan Inc., 25 Main St., Belleville 9, N. J., or check the card-number.

Helpful Data on Swimming Pools

364. Data on injector nozzles for complete recirculation, fittings for correct drainage and other useful information for pool design are covered in Manual SP issued by Josam Mfg. Co., Michigan City, Ind.

Gate Valves

369. A new publication has been issued especially for designers of sewage and waste treatment plants. Write for Circular No. 24 to M & H Valve and Fittings Co., Anniston, Ala., or check the card-number.

Controls for Water and Sewage Pumps

428. Condensed data sheet gives you valuable information on applications and operation of Roto-Trol controls. Before you design automation in pump service, write Healy-Ruff Co., 2255 University Ave., St. Paul 14, Minn., or check card number.

Tips for Installing Orangeburg Pipe

336. Good practice for installation of Orangeburg pipe and fittings is outlined in an illustrated four-page bulletin made available by the Orangeburg Mfg. Co., Div. of The Flintkote Co., 375 Park Avenue, New York 22, N. Y. Trenching and backfilling, pipe laying, cutting and connecting.

Book Tells How to Control Algae

371. Details on the control of various microscopic organisms frequently found in water supplies are furnished in a 44-page booklet offered by Phelps Dodge Refining Co., 300 Park Ave., New York 22, N. Y. Check the reply card.

Microtraining:

A Success Story

375. New 4-page description of the Marston Lake, Denver, Colo., installation, from inception through tests to results and benefits. Engineers responsible for water, sewage and industrial wastes treatment will find it both interesting and valuable. Glenfield & Kennedy Inc., 275 Halstead Ave., Harrison, N. Y., or use the card.

Are You Using the Right Coagulant?

381. This question, and its answer, are included in new folder that packs much valuable guidance in water and sewage treatment. Read a little and learn a lot. Write to Tennessee Corp., Box 2205, Atlanta 1, Ga., or circle our card-number.

Trenches for Water and Sewer Line Construction

384. Three Cleveland J trenchers incorporating major advances in trencher design and operating advantages are described in Bulletin L-104 available from The Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio. Check the reply card for digging capacities, specifications and dimensions.

Water Works Couplings, Clamps and Sleeves

426. Fully described in useful 24-page booklet covering all your pipe needs. Ask for "Water Works Catalog" of Dresser Mfg. Div., Bradford, Pa., or just circle the number on this card.

Helpful Information on Elevated Steel Tanks

483. Factors to be considered in the selection of elevated steel tanks plus capacities, dimensions and particulars of many attractive designs are provided in 20-page Bulletin 101 of Pittsburgh-Des Moines Steel Co., Neville Island, Pittsburgh 25, Pa. Use inquiry card to get your copy.

Vertical Turbine Pumps

508. . . . with a history of low maintenance costs and practically no service calls. These data are offered you in the helpful literature to be had from The Deming Co., 293 Broadway, Salem, Ohio. Check number on inquiry card.

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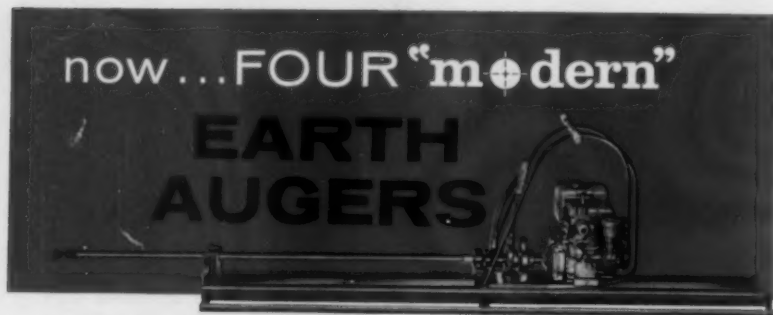
521. . . . and geared to mineral and chemical characteristics of your water. Complete design flexibility built-in to meet varied needs the country over. Get all the facts with Bulletin 58 of Buffalo Meter Co., Dept. PW, 2917 Main St., Buffalo 14, N. Y., or check the card-number.

Floatless Liquid Level Controls

543. Catalog describes the B/W system of liquid level control, liquid level relays, electrodes, signals and alarms with descriptions, charts and diagrams of typical applications. Check the reply card or write B/W Controller Corp., Birmingham, Mich.

A New Drilling Machine for Cuts in Pipe

569. Automatic, cuts up to 12"; and can be successfully operated even by inexperienced personnel to give faster, safer cuts. Take a minute to get this new folder 8881 from Mueller Co., 512 W. Cerro Gordo, Decatur, Ill., or just circle number on our card.



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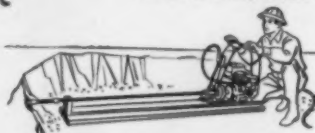
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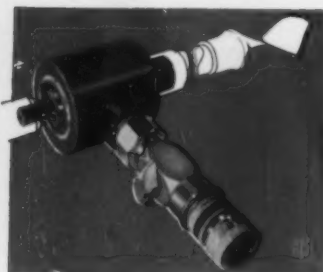


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DECATUR, ILL.**

Factories at: Decatur, Chattanooga, Los Angeles
In Canada: Mueller, Limited, Sarnia, Ontario

To order these helpful booklets check the reply card opposite page 34.

Metering Pumps

580. Get the full treatment in twin brochures filled with valuable data to the water works head who is on the lookout for all that is new in good chemical feed pumps. For yours, address Wallace & Tiernan, Inc., Belleville 9, N. J., or check our card-number.

Kohler Stand-by Units

Protection Against Power Failures

602. Dependable Kohler electric plants provide uninterrupted power for vital services when regular sources fail. Kohler Electric Plants World-Wide, folder E-402, illustrates models available for stand-by, sole supply, portable and marine applications. Sizes from 500 watt to 115 kw, gasoline, gas or Diesel operation. Write Kohler Co., Kohler, Wisconsin, or use the reply card.

Air Control Valves For

All Types of Pipelines

620. Literature on Crispin Air Valves, which safely control air in lines handling liquids, to maintain efficient operation and prevent expensive failures, is available from Multiplex Manufacturing Company, Dept. C, Berwick, Pa. Write today for your copy of the Crispin Air Valve Catalog, which offers complete information on the full line of dependable Crispin Air Valves.

Commentary on

Water and Sewage Treatment

629. This valuable 76-page booklet is made up of reprints of the articles on the subject by R. S. Rankin and published over a period of two years in PUBLIC WORKS. Your free copy may be had from Dorr-Oliver, Inc., Havemeyer Lane, Stamford, Conn. Use the reply card.

For Pipe Pushing and Pulling,

Cut Costs and Time

641. New folder describes continuous-motion machine that eliminates all resetting of grip. Hand or air powered for pipe 3/4 to 2 inches. Write for new folder to The Trojan Mfg. Co., 1112 Race Drive, Troy, Ohio or use our reply card.

Water Service Hydrants

and Outdoor Drinking Fountains

661. Water service hydrants in 4 sizes, 1/2", 1", 1 1/2" and 2" and all types of outdoor drinking fountains are described in a well-illustrated, 24-page catalog from The Murdock Mfg. & Supply Co., 426-30 Plum St., Cincinnati 2, O.

Electronic Locators for Water

Mains, Services, Valves and Boxes

677. Miniaturized line locator that is encased in a molded glass fibre container and has transistors that have a rated life of 70,000 hours and weighs only four lbs. when completely assembled is described in literature from Wilkinson Products Co., 3067 Chevy Chase Drive, Pasadena 3, Calif. Check the reply card.

Get the Sand out of

Your Meters and Pumps

680. There is a way to do this, the new Krebs centrifugal water/sand separator. How it does this is the subject of helpful literature to be had direct from Equipment Engineers, Inc., 737 Loma Verde Ave., Palo Alto, Calif., or by checking our card-number.

Bulletin Covers Step-by-Step

Action on the Water Problem

689. A step-by-step outline of action telling how the responsible citizens can help their officials extend and improve the local water system through more adequate rate structures on financing is covered in this bulletin available from Thos. F. Wolfe, Managing Director, East from Pipe Research Association, 3440 Prudential Plaza, Chicago 1, Illinois.

Measure Water Accurately

In Open Ditches and Channels

694. Parshall Measuring Flumes are widely used by Irrigation Companies, Farmers, Cities and Industries. All steel construction assures accuracy within 2%. Available in sizes for 0.1 to 1340.0 cubic feet per second. Catalog B-31-C contains free-flow discharge tables, sizes, capacities and weights. Thompson Pipe & Steel Co., 3025 Larimer Street, Denver 1, Colorado will send you a free copy for the asking.

To Insert Valves Under Pressure . . .

335. . . let your first step be review of this "step-by-step" folder on Mueller tapping and cutting-in sleeves and valves. Write Mueller Co., Decatur, Ill., for Form W-8899 or circle number on our card.

BUSINESS ADMINISTRATION

Save Space

By Filming Your Records

57. Microfilm your records by using the Recordak Microfilmer. Check the reply card or write Recordak Corp., 415 Madison Ave., New York 17, N. Y., for operation, use and price of this machine. Also available is literature on the Recordak Verifax Copier that makes certified copies 15 times faster than typing.

If You are Considering a trustee

for a Bond Issue Check with

Chase Manhattan

236. For details on how a bank serves as trustee for bond issues for any municipal or governmental unit, write The Chase Manhattan Bank, 1 Chase Manhattan Plaza, New York 15, N. Y.

Monthly Time

and Cost Record Book

249. To assist owners in determining the cost of owning and operating equipment Caterpillar Tractor Co., News Service, Peoria, Ill., has prepared a 24-page monthly time and cost record book. Twelve sets of pages are included on which to record day by day machine expenses for an entire year. Check the reply card for your copy.

Stop Waste in Hand Washing

497. Quick cleanup after the job with a saving of soap and your employees' time is easy with Gojer hand cleaner and dispensers. You'll find it pays you, too. Get details from Gojer, Inc., Box 991, Akron 9, Ohio.

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Caught in the act!

This Wheeler 3890 Heavy-Duty Hydraulic Cutter is shown just as it cleanly snapped off a piece of large diameter pipe.

recommended capacities*

- ◆ Std. or XH Soil Pipe—all sizes
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- ◆ Terra Cotta or Tile Pipe—thru 36"
- ◆ Asbestos Cement Pressure Pipe

*sizes over 12" require optional extra chain

THE NEW WHEELER "SUPER" HYDRAULIC CUTTER



MODEL 5590

Recommended for 10" thru 20" Cast Iron Water Main and Tile through 42" diameter.

(sizes over 18" require optional extra chain)

All Wheeler "Squeeze and Pop" pipe cutters are simple to operate. No rotation. All you do is wrap the chain around the pipe, engage it in the cutter's upper jaws, adjust out slack and operate the separate hydraulic pump.

The Wheeler Mfg. Corp. P. O. Box 688 Ashtabula, Ohio

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CHIPPER

The exclusive Spring-Activated Feed Plate of the Fitchburg Chipper assures smooth, efficient, **SAFE** operation. This built-in engineering development, which makes trouble-free operation possible, has been patented.

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This safety feature is important. "Because of the feed plate with its safety spring the men can't get hurt by any back-throw from the Chipper," explains the Superintendent, The Park and Shade Tree Commissions, Bridgeton, New Jersey.

Please send in the coupon for more information, and for copies of articles on chipping which appeared recently in leading publications. These feature articles describe five methods of brush disposal, and ten new ways to utilize "by-product" chips. Send for your copies, they are well worthwhile.

Plan on *low-cost* disposal of trimmed branches, whether it's for a tree company, utility, highway department, a city, or a park department—plan on getting a Fitchburg Chipper.

This well-engineered and rugged machine turns brush into easy-to-dispose-of chips, at very low cost. Only the Fitchburg Chipper has an exclusive, patented Feed Plate which automatically adjusts for any size brush up to its rated capacity, making it possible to chip large or small material with ease.

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To order these helpful booklets check the reply card opposite page 34.

SEWERAGE AND WASTE TREATMENT

A Short Course In Pipe Jointing

169. The story of rubber couplings for clay and concrete pipelines is graphically presented in the booklet "Pipe Enterprise", published by Hamilton Kent Mfg. Co., Kent, Ohio. Detailed description of pipe jointing methods; photos showing jobs where Tylox gaskets met the need for easily assembled permanently tight joints installed under all conditions; and a report on the development, manufacture and outstanding features of the compression type gasket make this booklet valuable to every engineer and contractor. Check the reply card.

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute c/o Editor, Public Works, 208 So. Broad St., Ridgewood, N. J. Check the reply card and we will forward your request.

Acid-Resistant Pipe Linings Can Be Applied in Place

29. The Centriline Process for cement-mortar linings is enlarged to include application of an epoxy-resin 100% solids system to pipe lines in place. Designed for repair and protection of concrete and vitreous sewer lines. Get literature from Centriline Corp., 140 Cedar St., New York 6, New York, or use our reply card.

Theory of Controlled Digestion With Floating Cover Tanks

88. In an excellent 40-page booklet, an authoritative discussion of digestion theory and practice, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13, Ill. Complete data are given on the use of floating covers, together with details on tank construction, piping and control chambers.

Rated Aeration Now Can Be Had in a Package

112. Chicago Pump's aerobic digestion sewage treatment plant is available as a factory assembled unit combining comminution, diffused-air aeration and settling for 1,000, 3,000, and 5,000 gpd loads. Write for bulletin on Rated Aeration SS, Chicago Pump, Food Machinery and Chemical Corp., 622 Diversey Parkway, Chicago 14, Ill., or check the reply card.

Catalog on the Flynn and Emrich Incinerator Stokers

180. This catalog describes the Flynn and Emrich Incinerator stokers as to design, feeding capacities and loadings. Plenty of drawings of the stokers and photographs of incinerator plants under construction and in operation are included. Also, there is a good section on the incinerator history. Check reply card for catalog No. 1702 from Flynn and Emrich Co., Holiday and Saratoga Sts., Baltimore 2, Md.

Technical Data on Plastic Sewer Main Pipe

226. An attractive and most useful booklet that gives the information you will need in considering this modern material for sewers. Goes into engineering details on stresses, crushing resistance and abilities to withstand acids, cleaning and all other common hazards to which working sewers are exposed. Ask for the book from Evanite Plastic Co., Uhrichsville, Ohio.

Use The Reply Card

New Incinerator Grate

250. The new Nichols Fuller reciprocating grate for continuous feed of refuse and continuous discharge of residue by automatic and completely mechanical means is described in new Bulletin offered by Nichols Engineering and Research Corp., 80 Pine St., New York 5, N. Y., or check its number on our card.

New Way to Clear Clogged Sewers

415. . . . is described in a circular telling what happens when ZEP Sewer Aid is introduced into sewers and industrial wastes drain lines. Claimed that not even tree roots can resist it. Inform yourself with this "Report 20," to be had from Zep Mfg. Corp., P. O. Box 2015, Atlanta 1, Ga., or just circle our card-number.

Be Independent of Power Failures

432. As a first step, ask for catalog of engine-driven generating sets for standby or continuous duty service. Range from 500 watts up through 150 KW in gas or gasoline models to 750 KW diesel category. Address Katolight Corp., Mankato, Minn.

Data on Adjustable-Speed Magnetic Drives for Low-Lift Pumps

445. A catalog is available from Electric Machinery Mfg. Co., Minneapolis 13, Minn., that tells all about R-M Vertical Synchronous Motors and Magnetic Drive Units. Engineers check the reply card for information on this equipment for sewage pumps.

Wedge-Lock "O" Ring Joints for Vitrified Clay Pipe

482. Joints for large diameter pipe, using the Wedge-Lock principle of factory made joints plus a rubber "O" ring for compression sealing, described in 4-page folder of Evans Pipe Co., Uhrichsville, Ohio. Check reply card for your copy.

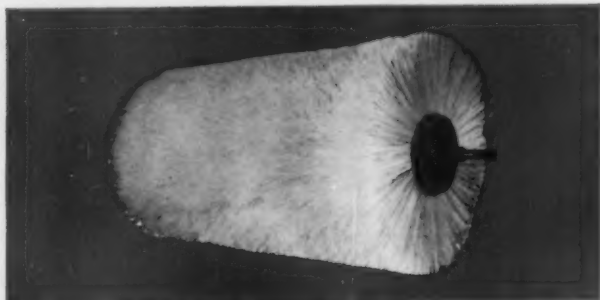
Descriptive and Performance Data on Sump and Sewage Pumps

483. Performance tables, selection charts, architect's and engineer's specifications and descriptive bulletins on Pacific sump and sewage pumps are available from Pacific Pumping Co., 9201 San Leandro St., Oakland 3, Calif., or by checking the reply card.

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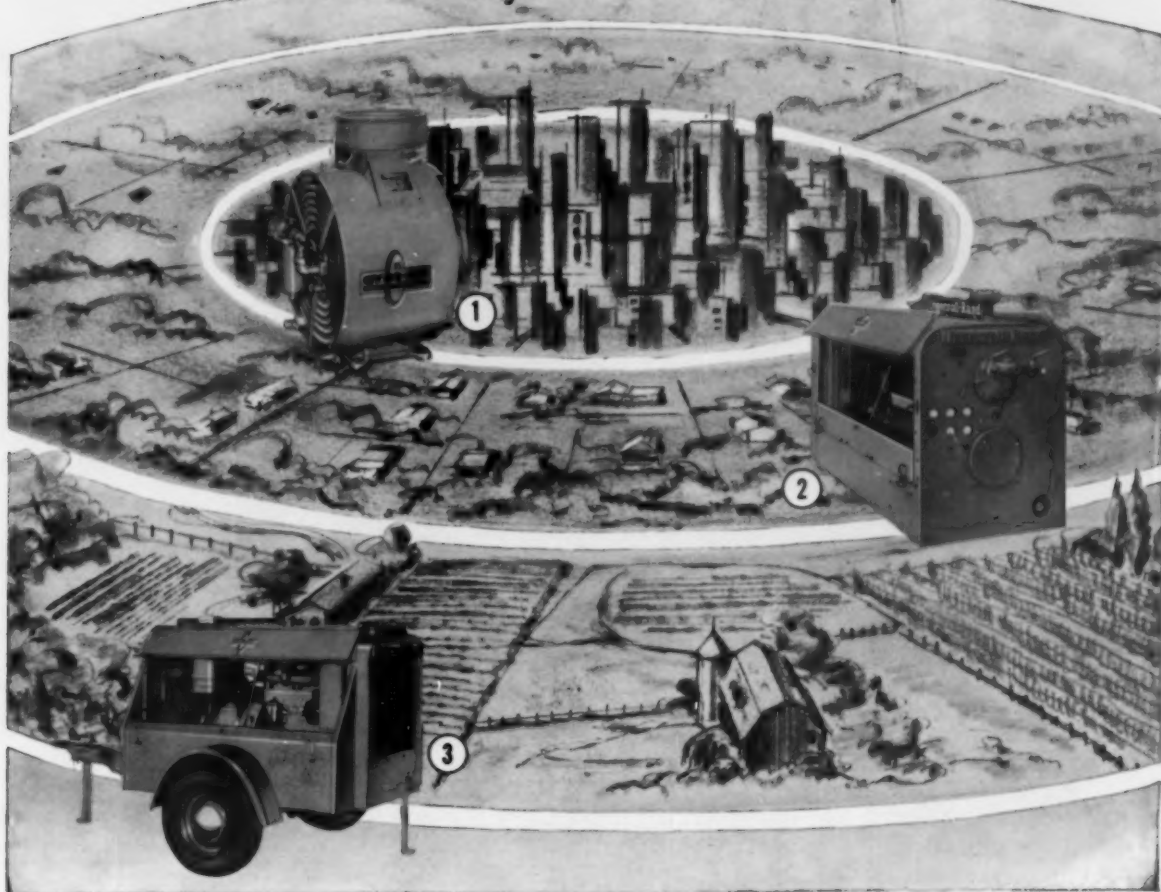


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It's the Power-Takeoff unit

This super-compact Gyro-Flo compressor, for direct or belt drive from the service truck power-takeoff, is ideal for busy metropolitan areas where truck size must be kept to the minimum. These 85-cfm and 125-cfm compressors take less than 3.6 and 4.9 sq ft of floor space respectively, leaving plenty of extra space for men and equipment. Air-operated engine speed control and combination air receiver and oil separator can be mounted wherever convenient.

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Where there's ample room for needed equipment at the job site, the completely self-contained Gyro-Flo portable compressor offers maximum convenience, flexibility and economy. You can tow it to the job and immediately release the truck for other work. Wheeled units are available in sizes from 85-cfm to 900-cfm, to meet any air power requirements.

Ask your Ingersoll-Rand Distributor or engineer for complete information on the Gyro-Flo that will meet your needs to best advantage.

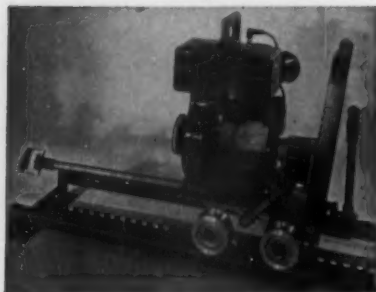
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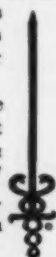
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*13½ times as much as you
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Shocking? Yes. And here's another shocking fact: in 1961, cancer will strike in approximately two out of three homes.

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If you do that, you will be giving \$450,000,000 to fight cancer this year. Thirteen and a half times as much as last year! Fight cancer with a checkup—and a check to the American Cancer Society.



To order these booklets check card opposite page 34.

Usiflex Boltless Flexible Joint Pipe

471. New 8-page booklet describes joint provided with Usiflex pipe. Simple, rugged bottle-tight joint for cast iron pipe which is assembled without use of bolts. Locked against pull-out and offered as ideal for underwater installations. Address: U. S. Pipe and Foundry Co., 3300 First Ave., North, Birmingham 2, Ala., or check our card-number.

Sewage Treatment Engineering Data Manual

511. This manual contains a brief outline of the various accepted methods of treating sewage and some of the problems, advantages and disadvantages of each. Check the reply card or write Smith & Loveless, Inc., Division—Union Tank Car Co., Lenexa, Kansas for design notes, charts and drawings.

The Tractor that Comes Nearest to Doing Everything!

529. Among other unique features it lets you drive with toe-operated Hydro-Shuttle, change speed or direction instantly. High torque at low rpm means no stalling under heaviest loads. Many other advantages described in MoTrac booklet. Get your copy from Minneapolis Moline, Hopkins, Minn., or ring the number on card.

Gas and Gasoline Engines Described in Literature

535. Roiline engines (formerly LeRoi), gas and gasoline models are built as bare engines, complete power units, and with components and accessories for special services. Check the reply card or write Waukesha Motor Co., Waukesha, Wisc., for details on the use of these engines in compressor, generator and pumping installations.

For Prompt Service Use The Reply Card

Design Manual on Sectional Plate Pipes, Arches and Pipe-Arches

530. Size and weight tables, minimum gages for live load strutted and unstrutted, layout details and plan developments are some of the material covered in this manual. Write American Bridge Div., United States Steel Corp., 525 William Penn Place, Pittsburgh, Pa.

Something New in the Incinerator Field

577. A reciprocating grate stoker described and illustrated. Brochure shows how it provides new answers to old incinerator operating problems. Just write for Pamphlet 701 to Detroit Stoker Co., Monroe, Mich., or circle number on the card.

Three New Sewer Rodding Machines

594. Just announced and worthy of your attention. Literature describing them and their new features will be a valuable guide for your sewer rodding operations. To secure it address Flexible, Inc., 415 S. Zanga Blvd., Dallas, Texas; or circle our card-number.

Play Safe with Automatic Controls

603. Remote engine and pumping controls of every sort are fully described in a series of bulletins offered by Synchro-Start Products Inc., 8151 N. Ridgeway Ave., Skokie, Ill. Write them or circle the above number on our card.

Economical BOD Removal by a "Total Oxidation" Sewage Plant

637. For airports, institutions, subdivisions, shopping centers and similar installations—all described and illustrated in new booklet available from Inflico, P. O. Box 5033, Tucson,

Sludge Removers for Tanks of Any Size or Type

659. The Rex Unitube Tow-Bro Sludge Remover is described as a proven standard of the industry. Bulletin 315-81 shows how Tow Bro can be applied to tanks of any size or type. Write Chain Belt Co., Milwaukee 1, Wis.

Reinforced Plastic Pipe and Fittings

549. . . . for water and sewage service, in sizes 2 through 8 inches, made of epoxy resins and glass, highly resistant to hydrogen sulfide gas, electrolysis and difficult soil conditions. Booklet tells all in 16 illustrated pages. For your copy write Amercoat Corporation, 4809 Firestone Blvd., South Gate, Calif., or circle number on the card.

Judging Engine Quality

565. . . . may be hard but this 26-page booklet emphasizes the features of various designs which provide you with top engine performance for minimum cost—original and or final. Cutaway illustrations compare these features for quick grasp of their importance. Write for Form 20185-DN935 to Caterpillar Engine Div., Peoria, Ill., or just check off our card-number.

Reinforced Concrete Pipe For Culverts and Sewers

672. Elliptical Lo-Hed and Hi-Hed pipes, round pipe and flat base pipe are described fully in literature from American-Marietta Co., Concrete Products Div., 101 East Ontario St., Chicago 11, Ill. Headwall details, discharge curves, hydraulic capacity tables and hydraulic properties are included. Check the reply card.

STREET LIGHTING AND TRAFFIC CONTROL

Much Cheaper than Cops . . .

31. Is good street lighting in preventing crime. To guide you to better lighting there is a new Kerrigan booklet. "A Bright City is a Safe City." Describes full line of lighting standards, also how to promote better lighting in your city and county. Address, Lighting Standard Div., Kerrigan Iron Works Co., 1033 Herman St., Nashville, Tenn. or use our card.

Latest Data on Davits for Lighting Standards

77. Is in a just-issued 12-page catalog. In it are classified the various davits available by mounting height, appearance and arm extension. Ask for this booklet by name from Pfaff & Kendall, 84 Foundry St., Newark 5, N. J., or circle our card-number.

Complete Catalog on Traffic Control Equipment

240. All types of controllers, PR system of coordinated traffic control, vehicle detectors, timers, vehicle counters and radar speed meters are covered in catalog available from Automatic Signal Div., Eastern Industries Inc., Norwalk, Conn. Check the reply card.

No Idle Trucks with these Spreaders

397. New 8-page catalog gives features, specifications, users' statements on the Fox Mountable spreaders, equally good for sand, cinders, chips, salt, calcium chloride. Designed for one-man operation and year-round use. Wide widths and high speeds. Mounts or demounts in 15 minutes. Write Fox River Tractor Co., Box 469, Appleton, Wisc., or check our card number.

Sign Catalog Has Latest Specifications

417. Detailed information on all classifications of standard signs for traffic control, street identification and other purposes together with a complete line of accessories is presented in a convenient Sign Manual by Lyle Signs, Inc., 2731 University Ave., S. E., Minneapolis 14, Minn. Get Catalog B-55 for most recent data and specifications on U. S. Standard signs.

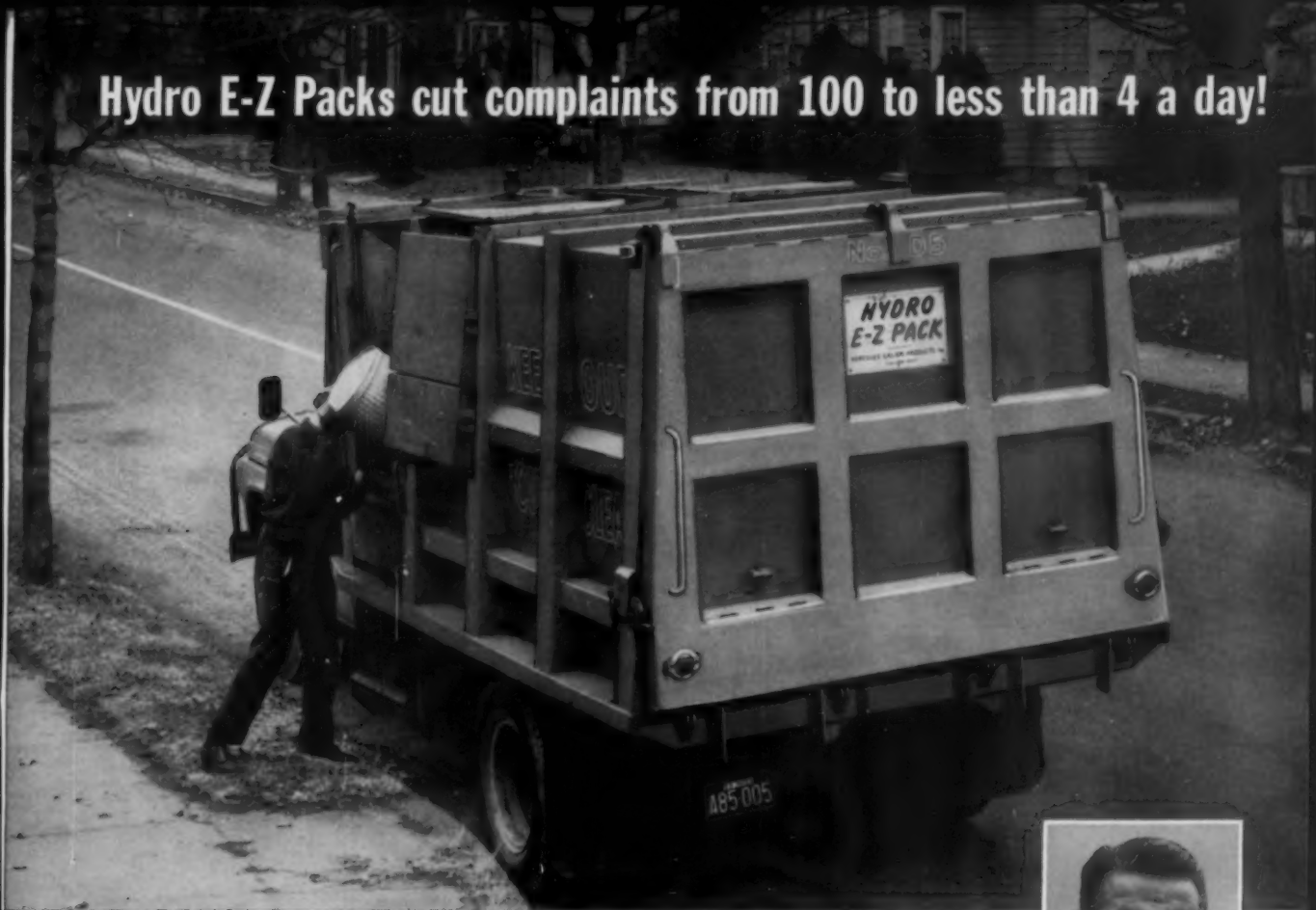
Highway Hazard Warnings

545. Gathered in one booklet is practically the whole story on warning devices and how to use them. Catalog 55 is veritable gold mine of such information. Covers lanterns, flashers, torches, safety suggestions. For your copy write R. E. Dietz Co., 225 Wilkinson St., Syracuse, N. Y., or circle card-number.

(More listings on page 52)

PUBLIC WORKS for June, 1961

Hydro E-Z Packs cut complaints from 100 to less than 4 a day!



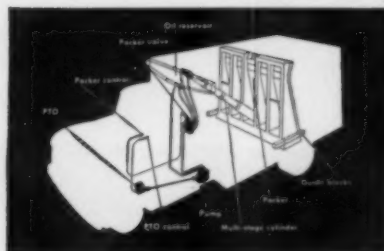
MR. PAT CAPELLO
Capello Bros., Inc.

"Clean, efficient, odorless E-Z Pack service protects 3-year contract - saves up to 15%"

In Newton and West Newton, Mass., Capello Bros., Inc. serve some 40,000 residents with twice-weekly residential and daily commercial refuse disposal under a 3-year contract with the cities. Mr. Pat Capello, co-owner, says complaint calls have been cut from 100 or more to less than 4 a day since 1958 when his firm won the contract with 12 Hydro E-Z Packs. "Our clean, efficient, odorless E-Z Pack service protects our nearly 1/2

million dollar contract and saves up to 15% on operating costs," he said. The savings estimate is based on reduced travel time and maintenance economy. "We haven't had one minute of 'downtime' in 17 months," Mr. Capello said.

Perhaps E-Z Packs are the answer to your refuse disposal problem. See your Hydro E-Z Pack Distributor or write us for a free copy of *The Big Squeeze*.



Simplest of all disposal bodies with the fewest working parts. No complicated chains, conveyors or whirling knives.



Bulldozer plow travels length of floor for compaction, beyond body for clean unloading of bale. No hoisting needed.



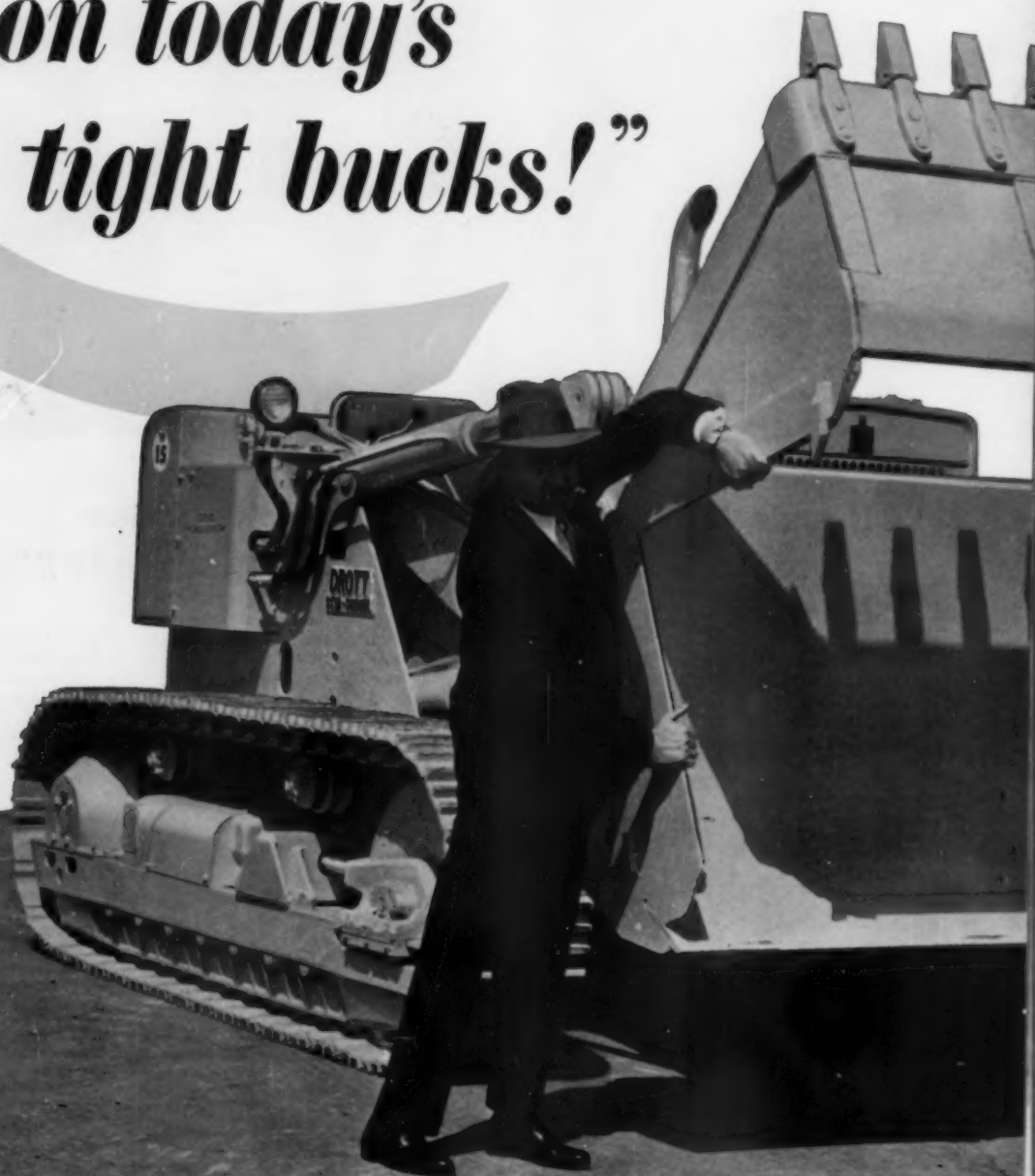
Lower cost with less depreciation since elimination of heavy and complicated mechanism decreases chassis requirements.



HYDRO E-Z PACK®

HYDRO E-Z PACK DIVISION OF HERCULES GALION PRODUCTS, INC., GALION, OHIO—U.S.A.

***“Mister...it
clam-action to ‘put the
on today’s
tight bucks!”***



*takes
bite'*

"15 minutes on this new '15' Four-in-One will prove you can't afford to own any limited-duty bucket!"

"Sure, a racehorse loader with a 'lock-jawed' bucket may gain you a few minutes a day—just dipping from a stockpile and dumping in a truck!

"But anywhere else we double-challenge you to stack any limited-duty loader against a new '15' clam-action 4-in-1, and see what happens. We can tell you right now what'll happen no matter what size, shape or color the single-action rig is, or how shifty it is! It'll get clobbered! And, profitwise, so will the guy who buys the obsolete bucket without bothering to find out what a slew of jobs the new '15' Four-in-One does.

"You can get the straight dope, first hand in 15 minutes, on this new TD-15 Four-in-One. In just one quarter-hour, you can prove what it means to own the one and only machine that doubles for a whole spread of contracting equipment—at the touch of a hydraulic lever.

"In only 15 minutes, you can put the 'bucket with the bite' through its paces. Prove how you get four, or a dozen, or more, full-sized, full-capacity machine actions with the exclusive 4-in-1. Prove you get hundreds of job-handling working positions with each action.

"See how new TD-15 Four-in-One get-up-and-go is tailored to set a fast work pace, with the single-stick shift, full-reverse transmission, and plenty of hydraulic control power.

"C'mon in now—take 15 minutes on a new '15' Four-in-One. Or call us for a demonstration on your job. See for yourself why you can't afford to own any obsolete 'lock-jawed' loader."

International Harvester Company, Chicago 1, Illinois
Drott Manufacturing Corp., Milwaukee 15, Wisconsin



INTERNATIONAL
DROTT

"Doze, grade, grab, spread, do cut-and-fill work, strip, load sticky materials, outshovel a power shovel, pick up loose materials (without chasing them), grub, load 'impossibles'. Do dozens of other profitable jobs with the new '15' Four-in-One that single-action loaders can't touch."



To order these helpful booklets check the reply card opposite page 34.

REFUSE COLLECTION AND DISPOSAL

Where Does It Go From Here?

63. That is the title of new 12-page booklet, D 930, with thorough discussion of garbage disposal by sanitary landfill method. Read the latest report from the experts. Caterpillar Tractor Co., Peoria, Ill., or check card.

Reduce Your Refuse Disposal Costs

150. A complete line of refuse disposal systems that include containers, giant containers, compaction bodies and compaction trailers are described in literature from Dempster Brothers, Dept. PW, Knoxville 17, Tenn. Check the reply card for data on these efficient systems.

Versatility, Compaction Force

Account For Extra Packer Capacity

159. The many advantages of this modern packer unit have been combined into a fact-filled bulletin entitled "The Big Squeeze" which is available from E-Z Pack Div., Hercules Galt Products, Inc., Gallion, O.

Lead-Packer 600 Points the Way to the Best in Refuse Collection

188. Bulletins W-200, W-220 and W-221 explain how the Gar Wood Lead-Packer gives faster operation, bigger payload, more compaction, a larger hopper and more dependable operation. Write Gar Wood Industries, Inc., Wayne, Mich., or check the reply card.

General Specifications

for Refuse and Garbage Trailers

231. Two bulletins, one on the Pak-Mor 38 cu. yd. tandem axle trailer unit and the other on the Pak-Mor 32 cu. yd. trailer for use with Model GRD Dempster are available from Pak-Mor Manufacturing Co., Box 14147, San Antonio, Texas. General specifications, power train, operating procedures, maintenance and lubrication and other helpful information are included.

Select Your Incinerator Scientifically

273. Here is a new swift simple way of selecting the correct industrial, institutional or business-use incinerators for various types of installations. The device is somewhat like a slide rule and takes in the variable factors which determine choices in incinerators. Get yours from Morse Boulder, Inc., 80 Fifth Ave., New York 11, N. Y., or check number on our card.

How to Construct

A Sanitary Fill

331. A new 12-page booklet which tells the most efficient method of sanitary fill construction and furnishes complete information on planning and operation is now available from Drott Mfg. Corp., Milwaukee 15, Wis. Get your copy by checking the reply card: you'll find this booklet both interesting and valuable.

Prompt Service on

Sweeper Refill Fibers

367. Here's a dependable source of power sweeper refill fibers, including domestic and imported types and gutter broom wire. To get all the data write A. Stiert & Son, Inc., Hatfield, Pa., or use our reply card.

Pushbutton Refuse Collection

469. Pushbutton control of the packing cycle is just one of the many features of the Mark II Collectomatic refuse collection unit. In addition the unit offers fast, safe loading; "Duo-Press" compaction; positive ejection without raising body; simplified maintenance. 13, 16 and 20 yd. capacities. For all details get Bulletin BH-60106 from The Heil Co., Milwaukee 1, Wis. Use the inquiry card.

Progress in Refuse Removal

495. . . registers a new high mark with the Hobbs Hyd-Pak 60 model. Gives lower loading height, watertight body, 3 "extra" yards all in one ultra-modern, proven piece of equipment. For details on this unit and a pick-up container system, address the Hobbs Hyd-Pak Division, 609 N. Main St., Fort Worth, Texas.

An Incinerator that Small Cities Can Afford

541. Informative folder shows how smaller cities and major institutions and industries alike are getting low costs and high efficiency with simple low cost Wilco Tepee Refuse Burners. Dimensions, specifications and descriptions included. For your copy address Wilco Machine Works, Inc., Box 3722, Memphis 14, Tenn.

WEED CONTROL

Chemical for

Roadside Weed Maintenance

234. Garlon is an easy to prepare and to use chemical in the control of roadside weeds and growth. For complete data write The Dow Chemical Co., Agricultural Chemicals Sales, Midland, Mich., or check the reply card.

Use The Reply Card

Remember When You Hoed Weeds?

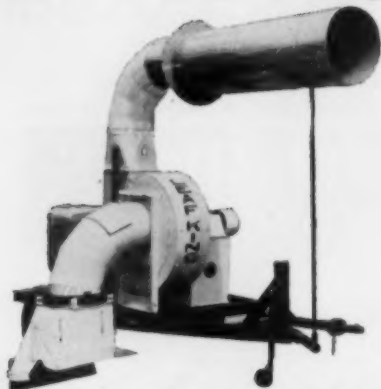
516. Not any more! For full data on how chemical weedkillers for roadsides make a clean sweep of obnoxious growth get booklet on AMIZOL, from Amchem Products, Inc., Ambler, Pa. Circle their number on our card.

Control Weeds and

Brush Along Highways

640. Literature from Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14, Ohio, describes how use of weed and brush killers help reduce accidents and also included is a handy, ready-reference control chart that covers weed control problems, quantity of solution to use and economical application. Check the reply card.

TARCO "Leaf King"



a Big, Powerful Vacuum Collector

The Tarco "Leaf King" has: 1. a large, water-cooled engine with built-in clutch . . . 2. a 36" wide, swivelling and shock-resistant shroud . . . 3. a replaceable steel innerliner in big suction case . . . 4. NO wearable hose in suction or exhaust line . . . 5. a unique, flexible and quick-connecting exhaust line to truck mounted box.

Fast and Efficient for big volume collection of leaves and litter.

See your Tarco Dealer or write for details.

TARRANT MFG. CO.

28 Jumel Place, Saratoga Springs, N.Y.

You'll Never
SAVE MONEY
on Cheap Substitutes
For . . .

. . . SUPER DeLAUARD

APCO CAST IRON PIPE

Centrifugally cast APCO Cast Iron pipe is made to last 100 years or longer. It's cheaper by far in final costs than any non-ferrous pipe your city can buy. With the fast assembly ALTITE® JOINT, it's easy, simple and inexpensive to install. Available from adequate stocks in sizes 3" through 24" in modern long lengths, ALTITE, bell-and-spigot, and mechanical joint.



Write for your copy of Catalog No. 54

**ALABAMA
PIPE COMPANY**

A Division of Woodward Iron Company

Phone AD 6-7601, ANNISTON, ALABAMA

Sales Offices

Chicago: 122 S. Michigan Avenue
New York: 350 Fifth Avenue
Kansas City: Suite 950, 1006 Grand Ave.
Detroit: 18505 W. Eight Mile Road
South Gate, Calif.: 5335 Southern Ave.

Five "330's" for Montana Highway Department

One of many governmental agencies enjoying the economy of LeTourneau-Westinghouse "low-budget" graders, the Montana State Highway Department recently added five LW "330's" to its fleet. Photos show one of its new 85-hp graders blade-patching a 600-ft stretch of highway near Billings — a job that, with the speedy "330", was completed in only 90 minutes.



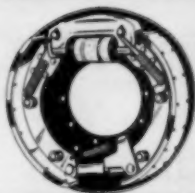
New-equipment budget tighter than ever? Look at the "economy-end" of the LW grader line



NEW!

Self-adjusting brakes

now available on LW graders. They're standard equipment on all models. Operating principle is the same as on some 1961 passenger cars and trucks. You simply apply brakes while backing up — and brakes adjust automatically.



Because the LeTourneau-Westinghouse 85-hp "330" and 100-hp "330 H" motor graders are available at rock-bottom cost, don't get the idea they're just "maintainers". Not on your life! Within their power ranges they'll do *every* type of big-grader work — high-bank cutting, ditching, sloping, mixing, scarifying, dozing, snow plowing, and many more of your hard work jobs.

Some of the big-grader advantages you get with the budget-priced LW "330" and "330 H" include: a transmission with 8 forward speeds to 23.6 mph, 4 reverse, and 3 optional extra-slow creeper gears. Positive blade controls. 12-ft. slide-shift moldboard. 100% engine-to-wheel anti-friction drive. Rugged one-piece frame. Rubber-mounted engine. And 12-volt electric starting.

Let us give you all the facts and show you these 85 and 100-hp graders in action. 5 other LeTourneau-Westinghouse graders available, 115 to 190 hp. Ask for details.

G-2386-PJ-1r



LETOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

To order these helpful booklets check the reply card opposite page 34.

CONSTRUCTION EQUIPMENT AND MATERIALS

Don't Stand There Figuring! How to Cut

51. Use the new Forney PSI Calculator "slide rule" for concrete products that includes instant conversion data from total load to psi on 17 standard test specimens and masonry units. Pocket size. Free. Address Forney's Inc., Tester Div., Box 310, New Castle, Pa.

Backhoe Attachments for Crane Excavators

59. The variety of attachments offers a wide choice of machines, allowing selection of tools for specific jobs including "V" buckets for pipeline and drainage ditch construction, blades for backfilling, "moles paw" for digging in clay and heavy duty rock buckets. 4-page Bulletin BH-60-1 describes the attachments and gives specifications and digging ranges. Write to Schield Bantam Co., Waverly, Ia. or circle the reply card.

Prestressing Concrete Beams

176. . . . is accomplished by high tensile steel wire. 20-page booklet gives application data for various forms of prestressing steel and tells how to order a strand assembly. Circle the reply card or write for booklet on American Super-Tens Wire for Prestressed Concrete, American Steel and Wire Division, United States Steel, Cleveland 13, Ohio.

Selection of a Small Packaged Air Compressor

387. Catalog 1548 contains tabular and chart information on cu. ft. of air required to operate a variety of pneumatic equipment, average and continuous air supply tables and charts on ratios of compression and tables on flow of air through orifices. Check the reply card or write Ingersoll-Rand Co., News Service Dept., Phillipsburg, N. J.

A Tape Measure on Wheels

272. You walk with it and it clocks off feet and inches like an automobile speedometer. Circular describing its many public works uses and full details available on request from B. G. Reilly Co., Box 231, North Scituate, R. I. or by using our reply card.

Specification Sheets on John Deere Tractors and Equipment

588. Information and specifications on the John Deere crawler and wheel-type industrial tractors and working equipment. Deere & Co., Industrial Division, Moline, Ill. Check the reply card. State type of tractor and equipment.

Pneumattractors, Their Tools and Accessories

489. These machines, applicable to a multitude of jobs, are comprehensively described in a folder that every public works official and engineer will find revealing and useful. Ask for Catalog 5945 from Schramm, Inc., West Chester, Pa., or ring the number on our card.

Use The Reply Card

Versatile Trenchers Mount On Jeeps or Tractors

504. "Gear-Draulic" boom-type trenching attachments by Auburn mount on tractor or Jeep, give new utility to your equipment. Get descriptive brochures from Auburn Machine Works, Inc., Auburn, Nebraska. Use the inquiry card.

Attachments For Ford Tractors

643. Clearing, backfilling, ditching, excavating, mowing, scarifying, sweeping, and trenching equipment are a few of the attachments described in literature from Tractor and Implement Div., Ford Motor Co., 2500 East Maple Road, Birmingham, Mich.

Color Catalog Describes

"Michigan" Tractor Dozers

631. A 20-page catalog on "Michigan" Models 180, 280 and 380 tractor dozers covers the design and operating features and explains how the hydraulic controls regulate all dozer operations. For your copy write to Construction Machinery Div., Clark Equipment Co., P. O. Box 599, Benton Harbor, Mich., or check the reply card.

"Rip the Daylights out of Masonry Sawings Costs"

635. What to do it with is fully described in new literature "New from Truco" on drilling machines, bits and accessories; also concrete, masonry and stone saws and diamond blades. Address Truco Masonry Drilling Division, Wheel Tracing Co., 3200 West Davison, Detroit 38, Mich., or circle number on our card.

The Complete Public Works Construction and Maintenance Machine

703. Is the apt title of a comprehensive folder on The Gradall which can be an eye-opener in describing its versatility in all public works construction and maintenance operations. Get the full picture by writing for "Population Explosion" folder to Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio, or check number on the card.

Versatile Crawler With Power and Controlability

707. Within this 24 page booklet (Form No. 607R) are liberally illustrated descriptions of the features of the Euclid C-6 for clearing, dozing, stripping, grading and a variety of other applications. Specifications covered. Circle reply card or write to Euclid Division of General Motors Corporation, Cleveland 17, Ohio.

100 HP Motor Grader

715. Model 330-H features a constant-mesh transmission, 3 forward and 4 reverse speeds, full-diesel rubber-mounted engine. With hydraulic brakes, ample strength and weight, and a wide range of blade adjustments. Write for bulletin (Form No. M6-174) from Le-Tourneau-Westinghouse Company, Peoria, Illinois, or circle reply card.

DETROIT RECIPROCATING GRATE INCINERATOR STOKER FOR MUNICIPAL AND INDUSTRIAL INCINERATORS

- Alternate lateral rows of reciprocating grates convey the refuse mass through the firing chamber, tumbling and tearing it, to expose its maximum surface to flame, and without manual poking.

- High resistance air metering grates prevent bare spots and blow holes.

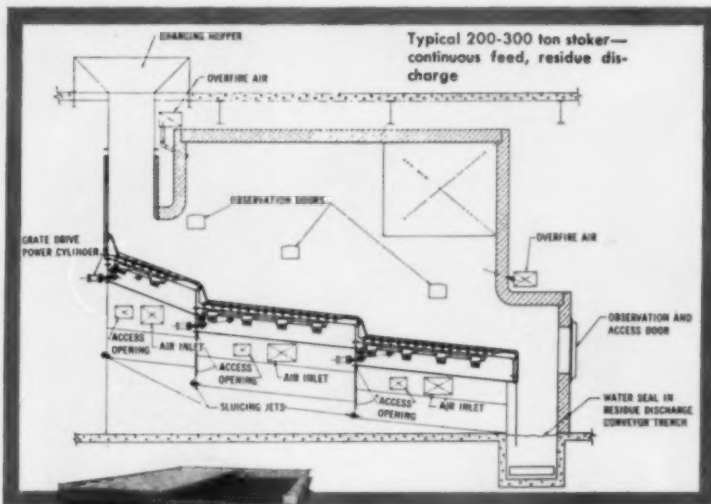
- Hydraulic drive, automatically controlled for selected frequency and length of grate-reciprocating strokes.

- Factory-assembled for shipment in modular units (single or multiple) for any size incinerator, assure a minimum of field erection labor.

- Full details and specifications in Bulletin 701. ASK for IT.

Also Available—

Detroit Rocker Grate Incinerator Stoker



Two-unit stoker with drives and controls, being shop-assembled

DETROIT
SINCE 1898
STOKERS

DETROIT STOKER COMPANY

DIVISION OF UNITED INDUSTRIAL CORPORATION

MAIN OFFICE AND WORKS • MONROE, MICHIGAN

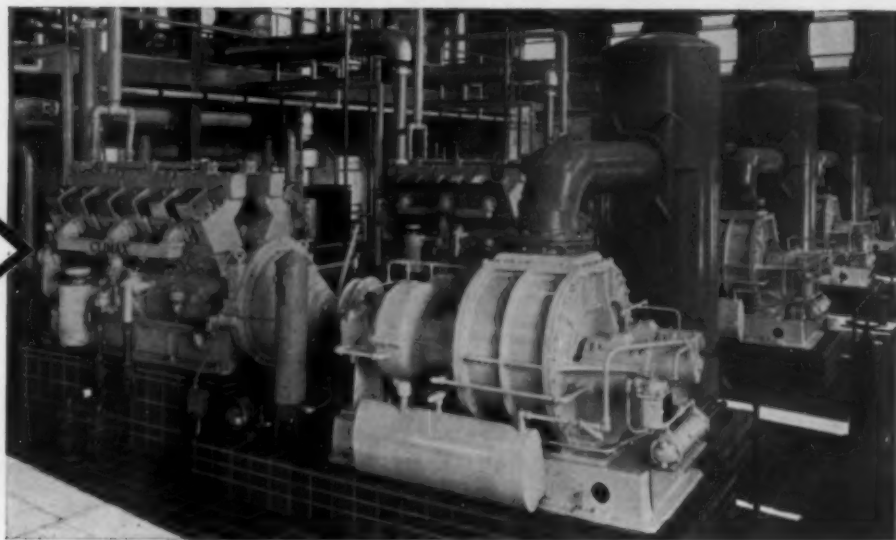
District Offices or Representatives in Principal Cities

in
this
Mansfield,
Ohio
\$4 Million
sewage
plant...



A SLUDGE GAS **CLIMAX** POWERS EACH 5250 cfm BLOWER

Four
CLIMAX
V-125
Engines



Mansfield, Ohio, puts money back in the taxpayer's pocket with Climax Power *economy*. In its recently completed sewage treatment plant, digester gas fuels the four Climax Engines driving the blowers. Used for aeration, grease and grit removal, are four 18 x 21 RCDH Roots-Connersville blowers. Capacity of each blower is 5250 cfm. And each has a V-125, 12-cyl., 7½ x 7-in., 3711 cu. in. displ. Climax Engine

operating on sludge gas at 650 rpm and delivering 225 hp. • Engineering Controls, Inc., St. Louis, Mo., supplied the vapor phase cooling system. Floyd D. Browne & Associates, Marion, Ohio, are the Consulting Engineers. • *Send for bulletins* on Climax sewage plant engines: 12, 8, 6 cyl.; sludge gas, or natural gas, butane, gasoline, or any combination fuel; 100 hp to over 600 hp.

CL-120

CLIMAX ENGINE MANUFACTURING CO. • DIVISION OF WAUKESHA MOTOR COMPANY
FACTORY—CLINTON, IOWA

To order these helpful booklets check the reply card opposite page 34.

STREETS AND HIGHWAYS

How to Prepare and Maintain Roadways With Calcium Chloride

65. "The Calcium Chloride Road," is the name of a new 24-page two-color catalog issued by the Pittsburgh Plate Glass Co., Chemical Div., 632 Fort Duquesne Blvd., Pittsburgh 22, Pa. Included are sections on dust control, gradation, placing and mixing materials and shaping. General information on spring, summer and fall maintenance is also provided.

International Wagner Heavy-Duty Loaders and Backhoes

195. International Wagner loaders and backhoes are matched with International utility tractors and are described in Catalog CR-1369-K available from International Harvester Co., Consumer Relations Dept., 180 N. Michigan Ave., Chicago 1, Ill. Check the reply card.

Information on Boring Machines

363. General operating instructions for the Earthworm boring machine, a portable compact unit for underground installation of pipe and conduit are available in new bulletin just released by Earthworm Boring Machine, Inc., P. O. Box 1100, Santa Monica, Calif. Suggested procedures for installing pipe or conduit and a price list are included.

Self-Propelled Ditching Machines

438. Information on a self-propelled one man operated ditching machine, model 324 T, model W-2 and a new midget ditcher, model 4 T, for light construction is now available from the Vermeer Mfg. Co., Pella, Iowa. The Model 324 T digs 8 to 24 inches wide and down to 6 feet deep, while the model 4 T digs 6 to 14 inches wide and down to 4½ feet deep. Model W-2 Ditcher digs from 2½ wide up to 4" down to a depth of 30". Full data on these ditchers available by checking the reply card.

To Sweep a Better Street for Less

162. Find out about what Protran can do to make your street sweeper brooms last longer, cut "down-time" and lower your cost per sweeping mile. A folder, with sample polypropylene filament is yours for the asking from E. B. & A. C. Whiting Co., Burlington, Vermont.

Don't Dig—Auger

328. Modern earth augers and their applications in installations under lawns, streets, highways, walks, buildings, etc. are discussed in this bulletin, A1-10M-2-60. Write to Modern Products, Inc., Exeter, Nebraska.

Bituminous Distributors for Public Works Uses

376. New "Road Builders" bulletin includes description of distributors 1000 to 1500-gallon capacities, including the Model 658 with "compact car" design, plus tar kettles, spreaders, and construction brooms. A lot of good information. Bulletin SE-60-25M, Standard Steel Works, Inc., North Kansas City 16, Mo.

Manual on All

Types of Traffic Signs

379. This 26-page manual covers regulatory, warning, school, railroad, street name, road construction, route markers, miscellaneous signs and plastic reflectors. Check the reply card or write The Miro-Flux Co., Inc., 1824 East Second St., Wichita 14, Kans.

1961 Truck Line Story From Chevrolet

446. The 1961 Chevrolet truck line is described fully in literature from Chevrolet Motor Division, General Motors Corp., General Motors Building, Detroit 2, Michigan. Check the reply card for data on this line of 163 models.

The Trucks You Need for Every Public Works Job

461. Extra life and operating economies are built-in features of every Ford truck model. There's a chassis size and engine for each of your needs, from light utility work to heavy-duty construction jobs. Get latest literature from Ford Motor Co., Truck Div., Dearborn, Mich., by checking the reply card.

Manual on Construction Castings

462. This 168-page Manual covers catch basin inlets and traps, building castings, manhole covers and steps, flap valves, wheel guards, drainage grates and many other construction and maintenance castings. Check the reply card or write Neenah Foundry Co., Neenah, Wisc., for your copy.

What Henry Didn't Know

About Tractors and What It Cost Him

513. This is the theme of a "comic book" that has as much sound information and sense in it as it has laughs. And there are plenty of both. Moral: Ignorance is not bliss when it is costing the tractor owner money. Your men will appreciate it. For copies, write for "Henry's Crawler," to Advertising Dept., J. I. Case Co., Racine, Wis. or circle our reply card.

Salt, Sand and Cinder Spreaders

532. . . . are fully discussed in folder No. A-450 outlining how these are dump body mounted for quick attachment and detachment according to service and season. Basic specifications outlined. Just address Baughman Mfg. Co., Jerseyville, Ill. or use the reply card.

Complete Line of Asphalt Patching Mixers

586. Mixers capable of mixing 3 to 20 tons of hot mix per hour are described in literature available from McConaughay Mixers, Inc., Lafayette, Ind. Check the reply card for full information on patching, repairing, resurfacing and sealing.

Here's a King-Sized Sucker-Upper . . .

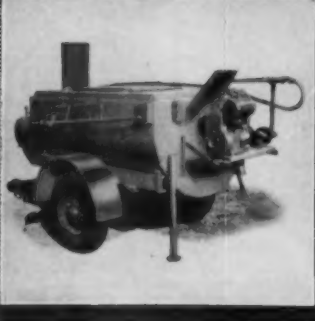
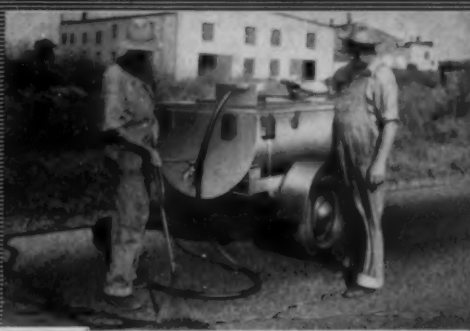
656. . . . that will rid your streets and gutters of leaves, litter and other bulky materials in record time. Cleans catch basins to 8-ft. depth in minutes. Bulletin PI, 758 S describes and illustrates this motorized Saver. Address Good Roads Machinery Corp., Minerva, Ohio, or circle number on card.

Patch ROADS THE LOW COST WAY

Temperature Easily Controlled

Easy to Transport

Saves Money on Patchwork



STANDARD STEEL TAR-KETTLES

PATCH AND MOVE ON IN MINUTES AND SECONDS

With this Standard Steel Model "S" Kettle, "cold spots" or "burnt materials" are eliminated. You get uniformity of heat throughout the entire mass of material. Steady temperature at the correct level is maintained all day long. Easily transported—equipped with special safety features—it's a fast worker. With a motor spray attachment, it is even more efficient for road maintenance. Standard Steel also offers a complete line of crack filling pots, shoulder rollers and other road maintenance equipment.

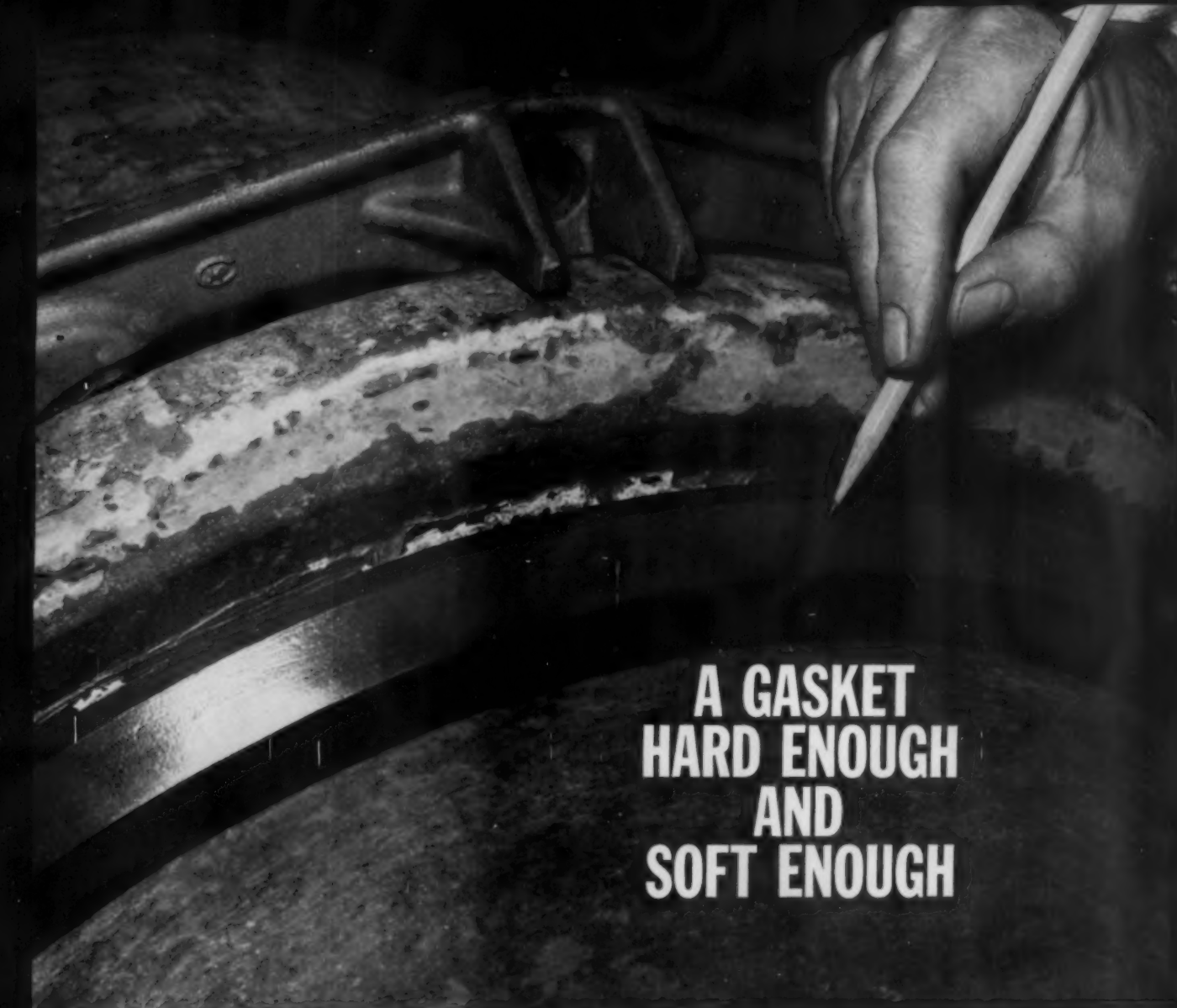
WRITE FOR CATALOG AND PRICES

OTHER PRODUCTS OF STANDARD STEEL

Asphalt Pressure Distributors, Maintenance Distributors, Patch Rollers, Supply Tanks, Tool Heaters, Asphalt Tools, Street Flushers, Construction Brooms.



Standard Steel Works, Inc., NORTH KANSAS CITY, MO.

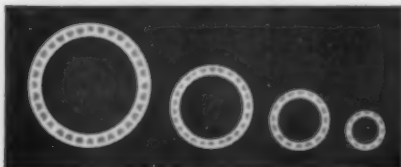


A GASKET HARD ENOUGH AND SOFT ENOUGH

The real secret to stopping leaks with CIP Bell-Joint Clamps



Style 60's complete adjustability fits both standard and pre-standard pipe perfectly. Your Dresser Distributor can also recommend methods of using Style 60 components on odd combinations of pipe.



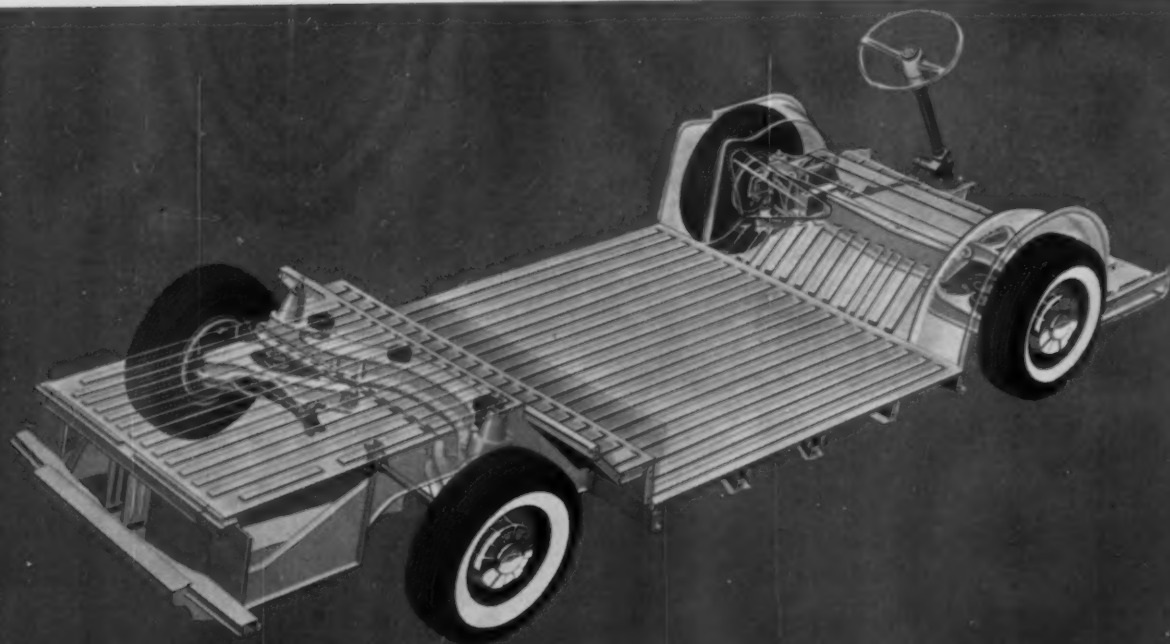
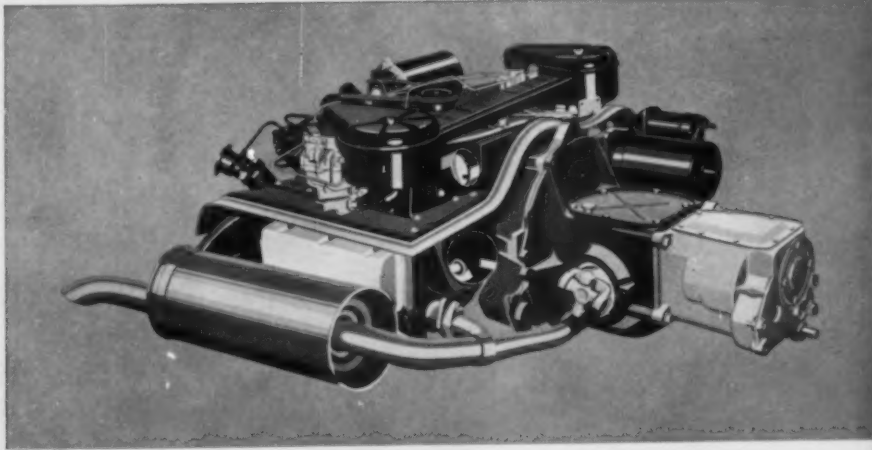
In all sizes, from 3" to 60", gasket sealing surfaces are at least twice the caulking space to allow for deflected and off-center joints.

Uniform gasket pressure, all around the bell face, is the key to successfully clamping bell joints. The rough face of the caulking is impossible to pack properly with a hard gasket. Yet, a soft gasket tends to flow and lose bolt torque in a matter of days. Only Dresser® Style 60 Bell Joint Clamps have specially compounded gaskets to give "just right" hardness...low permanent set...and aging resistance. ■ Your Dresser Distributor is anxious to give you the full story on the Style 60 as well as Dresser's complete line of pipe coupling and repair products. Call him today. Or write Dresser Manufacturing Division, 65 Fisher Avenue, Bradford, Pennsylvania.

dmd
DRESSER
MANUFACTURING DIVISION
BRADFORD, PENNSYLVANIA

DRESSER
INDUSTRIES,
INC.

OIL ■ GAS
CHEMICAL
ELECTRONIC
INDUSTRIAL



THERE'S A DOLLAR-SAVING DIFFERENCE IN CORVAIR 95!

We mean there's a whopping difference—the kind that puts a truck in a class by itself. You can see it, too, especially if you know where to look. In Corvair 95 design details, for instance—the things that tell you a truck is built with care throughout, crafted in a quality way that means more miles before trade-in and less expense along the route. We mean it's the kind of difference that will pay off in dollars every day on your job!

◀ **Power team and driver compartment—evidence of extra efficiency.** Tucked neatly between the rear wheels is the most practical truck-design idea in years—the Corvair 95 *Unipack power team*. Engine, transmission and rear axle are combined in one compact, durable unit. Power is delivered to the rear wheels by the shortest, most efficient route. This unitized power train design (including an engine that measures only 17" high) takes up less space—allows for plenty of cargo room in the big pickup body. The engine itself is something new in save-as-you-go power: a tough aluminum air-cooled 6 that moves your loads briskly on a minimum of gas. Up front, the big difference in Corvair 95 design is apparent in a cab that gives you bird's-eye visibility (no hood to limit vision), plenty of leg room, and a comfortable full-width foam cushioned seat (standard equipment).

◀ **Corvair 95's stay-together build goes unchallenged in this field.**

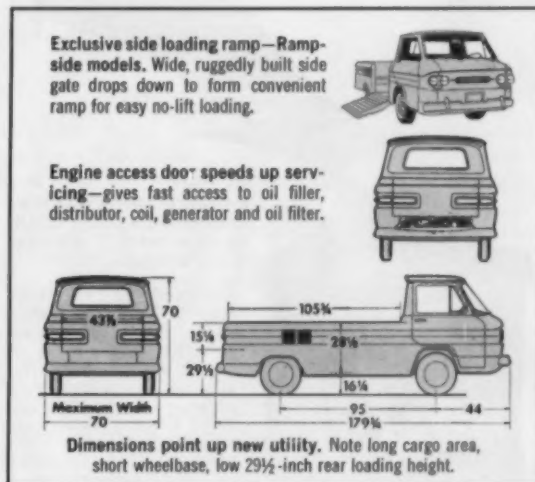
Super-rigid frame-floor assembly outperforms combination of separate frame and body floor. Eliminates a major part of a separate frame's weight.

Heavy-gauge crossmembers strengthen the underbody; form rigid foundation for front and rear suspensions—another reason for long truck life.

Friction-free coil springs at all four wheels assure top load-carrying capacity and smooth ride.

Precision Ball-Gear steering cuts friction (and wear) to a minimum; gives safe, easy steering.

Unitized body construction means maximum strength with minimum weight—for bigger cargoes.



There are literally scores of reasons why no other truck of this type can do so much to put you dollars ahead. There's a cargo area that's almost 9 feet long . . . with balanced weight distribution that enables a Rampside or Loadside pickup to carry up to 1,900 lbs. of payload with a 4,600-lb. GVW. There's a short 95-inch wheelbase for nimble maneuvering; deep-biting traction with engine weight in the rear; handsome styling that's good for business.

That's Corvair 95's special brand of *efficiency*, ready to give you bigger profit hauling in the years ahead. See for yourself at your Chevrolet dealer's. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

1961 CHEVROLET STURDI-BILT TRUCKS

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CARELESS WASH-UP PROCEDURES ARE COSTING YOU MONEY!

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GO-JO'S HEAVY DUTY DISPENSER CONTROLS WASH-UPS... SAVES YOU MONEY!

Designed to eliminate waste, the Go-Jo Heavy Duty Dispenser delivers just the right amount of Go-Jo to get even the grimest hands spotlessly clean. Go-Jo Creme Hand Cleaner is a concentrated formula containing GT-7 for dermatitis protection, plus soothing emollients to prevent chapping. When used in the Heavy Duty Dispenser, it provides four times as many clean-ups as "hand scoop" methods.

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The Go-Jo jobber serving your area will be happy to show you how to cut as much as 75% off your hand-leaning expenditures. Write us today.

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Ed Cleary Reports on:

Pollution Control Practice in Eastern Europe—Part 2

EDWARD J. CLEARY

Diplomate, American Academy of Sanitary Engineering
Cincinnati, Ohio

POLLUTION CONTROL in the Soviet Union and the adjacent East Europe countries is regarded as one of the most urgent problems relating to water-resources management. The authority for this statement is Dr. T. Nagibina, chief inspector for the protection of waters in the USSR Ministry of Health. Dr. Nagibina recently presented an account of steps that had been taken to deal with the situation to the Economic Commission for Europe. The ECE seminar in Geneva on February 22-March 3, 1961, was devoted to the administrative and economic aspects of water pollution.

Details on Russian practice were published last month (see page 86, May issue of *PUBLIC WORKS*). The following summarizes Dr. Nagibina's documentation of efforts being made in Czechoslovakia, Poland, Bulgaria, Hungary and Roumania. It is his general conclusion that almost identical methods of approach are being used. These include: Central-government planning and direction of control measures; prevention of new pollution resulting from industrial growth and urbanization while restoring the quality of already degraded water sources; and imposition of financial penalties for failure to comply with regulations.

All of the Eastern European countries have adopted the philosophy that regulations governing the discharge of wastes should be based on desired stream conditions and not on effluent standards. Quality conditions in the rivers and lakes are assessed on the basis of chemical, bacteriological and biological tests. This system of developing regulations, points out Dr. Nagibina, provides a rational basis on which measures of protection can be justified and their adequacy assured.

Situation in Czechoslovakia

Rivers in the Czechoslovakia Republic are said to be "considerably" polluted, and even ground-waters are polluted in places. Implementation of measures to correct these conditions have now been incorporated in the national economic plan of the country.

Practical measures on a national scale for the protection of waters were first taken in Czechoslovakia in 1950. A government decree made it compulsory to construct treatment plants for the waste waters from industrial enterprises and hospitals, and to take into account hydrological conditions and the qualitative composition of water sources when planning hydro installations. It was not until March, 1955, however, that legislation was adopted setting forth basic rules for management of the water economy and principles for the use and protection of water resources.



WHY IT COSTS LESS TO OWN A CAT GRADER

Most motor graders *look* pretty much alike, no matter who makes them. They handle similar jobs, too, and it isn't always easy to *see* any big difference in the way they handle them. In fact, the manufacturer's suggested prices usually are not greatly different for machines of nearly equal specifications—regardless of the “deal” that may be offered a buyer. But *used* motor graders vary considerably in price. Why?

The Buyer Determines Price

A used machine is priced at what the buyer is willing to pay . . . it's a measure of what *he* thinks is left in a machine. So, with used equipment, the buyer sets the price. This is clearly demonstrated at used equipment auctions. A check of auction prices throughout the country shows, for example, that the Cat No. 12 Motor Grader brings substantially higher prices than comparable machines of other makes—as much as 80% more. (Only machines of the same age, same condition and with similar attachments were compared.) What makes a Cat Motor Grader more desirable than other makes?

A Feature That Affects Cost

Any machine is desirable if it is known to be dependable. This reputation can

only be the result of true quality design and quality construction. The Cat oil clutch is a good example. It was designed and is built to give long, trouble-free life. But, how well does it do it? Let's examine the records of just one Caterpillar Dealer who has 161 oil clutch-equipped motor graders in his territory. His records show that in four years he has sold only \$24.38 worth of parts for motor grader oil clutches! One machine in his territory went 2524 service meter hours without any work on the clutch. Many users report 2000 hours of service before the first adjustment. In 1000 hours of operation only about .0025 inch of wear can be expected—less than the thickness of a human hair. And, since all parts are constantly bathed in oil there is no need for lubrication maintenance. Less wear, less attention mean not only lower total repair costs but more time on the job . . . less down time. Of course, the oil clutch is just one example of many quality features in Cat Graders.

A Look at Total Cost Records

The cost records of private owners and governmental bodies show which machines cost less. For example, an Indiana county keeps individual cost records on their six motor graders, 14 trucks, three loaders and five tractors.

Their records showed that a year-old No. 12 needed only a set of head gaskets and two spark plugs with \$25 labor, while two newer graders of another make needed major engine repairs, new clutches and side shift linkage. One town in New Hampshire reports that in over 20,000 hours, their No. 12 has never had a breakdown that held up work more than three hours. Operating costs—24¢ per hour exclusive of fuel, oil and operator. Comparing a Cat No. 12 to another make (after 3½ years' service), the records of an Arkansas county showed a saving of \$2478.57 in parts and labor for their No. 12.

What's in It for You

Others have proved that Cat Motor Graders cost less in the long run because they are built better in the beginning. Your Caterpillar Dealer has additional facts and figures on low-cost operation of Cat Graders in your area. Ask him for free Cost Record Books so that you can keep individual machine records on your equipment. Prove to yourself that it costs less to own a Cat Grader.

Caterpillar Tractor Co.,
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**give faster,
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for 1/8" to 6"

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This led to the issuance of a decree in December, 1957, under which waste waters must be treated until they attain a degree of purity laid down by the local water authorities in accordance with water quality standards issued by the central water economy directorate. In addition to the establishment of standards, the decree also calls for the classification of rivers for assessing pollution conditions.

The classification system establishes five categories, the criterion being the suitability of the river water for drinking water supply and for the technical needs of the national economy: (1) completely pure; (2) pure; (3) fair; (4) unsatisfactory; and (5) completely unsatisfactory.

Rivers or sections of rivers in the third or any lower category are not considered suitable for drinking water, and those in the fifth category are considered altogether unsuitable for any economic and productive purpose. The criteria for assessing the degree of pollution are: Five-day BOD, dissolved oxygen, hydrogen-ion reaction, coliform content and "areas of putrefaction."

Limits of maximum permissible concentration have been established for thirty toxic substances as well as for radioactive materials. The concentration limits have been derived primarily from references in international literature; on the whole, they are identical with USSR standards, differing only in the case of the following five substances. Selenium: 0.05 ppm. as against 0.01; zinc: 5.0 as against 1.0; cadmium: 0.1 as against 0.01; fluorine: 1.0 as against 1.5; hydrogen sulphide: 0.5—not used as a criterion in the USSR.)

Under Czechoslovak law waste producers must reclaim all possible by-products; they must construct appropriate treatment works; and must improve the facilities as treatment techniques evolve.

The country-wide planning and coordination of all work related to the utilization and protection of water resources comes within the province of the water economy department of the Ministry of Agriculture, Forestry and Water Economy. The work of this department is supplemented by the water economy divisions of the territorial and district national committees.

Control of phenol wastes is considered one of the main problems in Czechoslovakia. In 1956 a phenol committee was established under the chairmanship of a senior official of the water economy department. This committee issued recommendations for the elimination of phenolic pollution and advises enterprises on the solution of specific problems. It keeps a record of all enterprises discharging phenolic wastes, establishes a program of priorities for construction of phenol-recovery plants, and supervises execution of the program.

It is of special interest, stated Dr. Nagibina, to report the efforts being made in Czechoslovakia to create public awareness of pollution problems by means of films and posters.

The Situation in Poland

In the Polish People's Republic large sections of water courses and lakes have become polluted with the increasing development of industry. However, the need for protecting waters was recognized in legislation adopted as early as 1922. A major detriment to enforcement of laws and regulations was the opposition of industrialists who did not wish to bear the cost of remedial measures.

In 1954 the Polish government set up a state in-

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offers models of electric
submersible
dirty water
pumps!

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Capacities 85 to
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Who but Flygt could offer a complete electric submersible pump line . . . backed by experience gathered from performance the world over. It has taken years, not months, to engineer what is offered today as the most economical and trustworthy pump line on the market . . . with qualified sales and service representatives throughout the United States and Canada.



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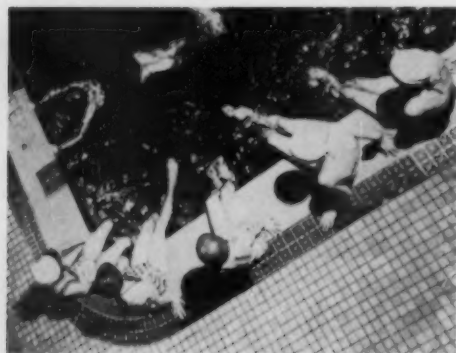
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Scum—the problem of ordinary pools—is washed over the coping and out of the pool into properly located skimmer drains. This eliminates hard-to-clean scum gutters above the water line, saves the cost of formed tile gutters and 5" to 10" of excavation and concrete walls.

A few typical water level deck pool fittings are shown here, but for complete details, write for Manual SP-7, the "authority" on drainage for all types of pools.



Series No. 0290
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spectorate for the protection of water. This was followed in 1957 by the establishment of a central water economy authority under the Ministry of Water Transport and Water Economy of the Republic. In 1960 this authority was designated as an independent department responsible to the Council of Ministers of the Polish People's Republic. This department then assumed all functions relating to administration of the country's water economy, the issuing of regulations for the use of water, control of water, annual inspection of quality and quantity of waste water discharged and also compliance with water-protection measures.

Under existing legislation water pollution is evaluated under a system classifying rivers or sectors of rivers into four categories: (1) not polluted; (2) slightly polluted; (3) considerably polluted; and (4) strongly polluted.

Evaluation is based on: External appearance of the water course or lake (or sections thereof); odor of the water; percentage of oxygen deficiency; five-day BOD; acidity; organic nitrogen; suspended matter; toxic substances; and biological indicators.

At present, a new classification scheme is being developed and soon will be submitted to the Polish government for consideration.

Bulgaria, Hungary and Roumania

In the years prior to World War II when the economy was predominantly agricultural, the pollution of water courses and lakes in the Bulgarian People's Republic was not as significant as it is now because of industrial development, reported Dr. Nagibina.

In November, 1953, the national assembly of the Bulgarian government passed a water economy act. Under this act, "all surface and ground waters are state property, belonging to the whole nation, and are to be used in the interests of the national economy for the development of the productive forces and the immediate satisfaction of the workers' needs."

The Bulgarian Ministry of Agriculture plans and supervises the utilization of water and exercises technical supervision over its use and protection. The national economic plan envisions the construction of treatment plants on an intensified scale in the coming year, principally for municipal sewage, which in most instances is said to receive industrial waste waters. Meantime, the Ministry of Agriculture, the Ministry of Public Health and the Ministry of Municipal Economy and Public Amenities are held responsible for issuing regulations governing discharge of all waste waters.

In its general aspects, water pollution control in the Hungarian People's Republic and the Roumanian People's Republic takes much the same form as in the Bulgarian People's Republic, stated Dr. Nagibina. Standards and principles underlying the rules for the discharge of waste waters into water courses are identical with those adopted in the Soviet Union.

International Uniformity Desired

In concluding his observations, Dr. Nagibina pointed out that standards for evaluating the quality of water, systems of river classification and methods of analysis, are not the same in all the countries. This is not considered of decisive importance in the case of measures relating to waters within a single country. But in order to evaluate pollution when measures for the protection of internationally-used waters have to be coordinated, it would be useful

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The fast loading cycle of the Mark II is under full control of operators at all times through push-button electronic control.

Packing operations may be stopped instantly with the safety stop-button, or reversed during any part of the loading cycle.

Push buttons are located at both sides of the loading opening. This safe, simple control speeds collection, reduces operator fatigue, eliminates expensive downtime for maintenance and adjustment.

Here is one more reason why a Mark II is the most efficient refuse collection unit on the market today. Get the complete story from your Heil distributor. Capacities: 13, 16 and 20 cu. yd.

Some Other MARK II Advantages:

- Safe, fast loading with no jamming.
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- Low clearance height — even on 20-cu.-yd models, it's less than 7 feet.

Plus "Duo-Press" compaction to increase payloads . . . cut operating costs.

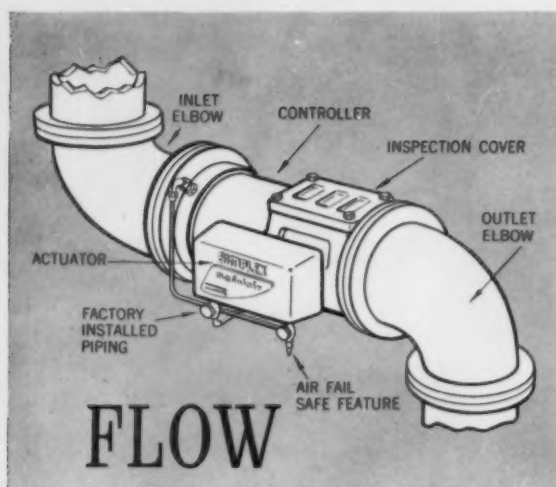
Entire load is uniformly compacted between packer and ejection plates — from first to final loads. Increases payloads up to 15 percent or more . . . cuts operating costs accordingly.



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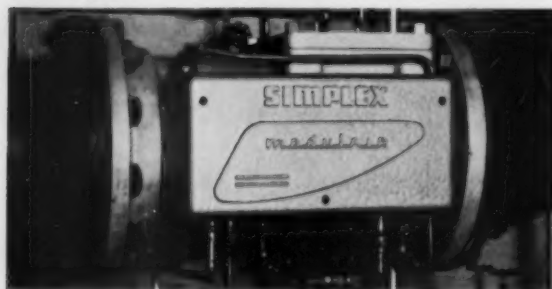
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This is the Modular Type "P" rate-of-flow controller, for your filter effluent piping.

You install it almost as easily as a piece of pipe, and its design is so utterly simple that you have almost no maintenance cost.



Note how Modular "P" flow controller requires very little space in filter effluent line.

In fact, the minute you put this venturi-actuated, fully pneumatic controller to work, you get these new savings:

1. No valve operator
2. No water supply
3. No hydraulic valves
4. No drive gears and linkage
5. No "spaghetti" of complicated piping
6. No pilot valve or valve shaft
7. No leaky packing gland
8. No floor drain
9. Almost no maintenance

You save space, too, because the "P" controller has the shortest laying length of any, in addition to being entirely preassembled, with all working parts enclosed.

Send for our Bulletin 951, for details on space and cost savings of the "P" controller. Compare them with your present method of flow control. No obligation.

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to have uniform standards classification and analytical methods. The need for further international co-operation was stressed because of its social and economic implications.

Experience of the USSR in elaborating and providing a scientific basis for the establishment of purity standards has resulted in the adoption of these standards in almost all of the Eastern European countries. Judging from the references in the literature, the work in the Soviet Union has received recognition in a number of West European countries as well, said Dr. Nagibina.

Regarding research activities it is Dr. Nagibina's view that in all of the countries on which he had reported, activities are being directed toward the following objectives: (1) Reduce waste losses in industries by the use of different technical processes and the recovery of by-products; (2) reduce wastewater discharge to a minimum by the introduction of techniques not involving the formation of waste waters and permitting water to be recycled; and (3) to find effective and rational economic methods for treating domestic and industrial waste waters.

Some duplication of work occurs in the various countries in research relating to the problems particularly pressing to each, and quite especially to waste treatment in the various branches of the chemical industry. It was believed that much of this could be avoided if some means were developed to promote international coordination of research in the preparation of international recommendations.

As stated in the first installment (see *PUBLIC WORKS*, May, 1961, page 86) the survey of Dr. Nagibina may be regarded as one of the most significant contributions in the annals of European pollution-control practice. Dealing as it does with the experiences in the Eastern European countries, it is a valuable supplement to an earlier documentation (made in 1954) by Dr. Arthur Key of England, which outlined the situation in Western Europe.

At a future date it might be hoped that Dr. Nagibina would pursue his documentation still further, somewhat along the lines used by Dr. Key, with the addition of some statistical information. Such things as population in each of the countries, the number sewered and the number of people served by sewage-treatment works, or the volumes of wastes treated, would be helpful in appraising the relative magnitude of the problem.

• • •

Iowa Highway Communications Net

The Iowa State Highway Commission has made its first step in a planned state-wide county maintenance communications system. A contract for two-way radio networks in five counties was awarded to Motorola Communications and Electronics, Inc. Installation will be completed early this summer. Meanwhile plans are being formulated for similar systems in the 94 other counties.

Installations in each of the five counties will consist of one mobile repeater to provide county-wide car-to-car and car-to-base communications and from one to three control stations in Highway Commission shops and garages. A total of 64 transistor powered mobile units will be installed in maintenance vehicles serving the Interstate highways in the five counties. These include heavy-duty snow plows, 2-ton trucks, ½-ton pickups and sedans used by supervisors and resident maintenance engineers. The five networks operate on high band frequencies.



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Saves time and labor . . .

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These are typical times for removal and replacement without the prior removal of any integral components . . . think what these savings in time and labor can mean in lower operating costs and increased productive work time!

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Proven components . . . GM 6-71 engine, Allison Torqmatic Drive and Euclid planetary final drive . . . dependable, efficient and balanced, it delivers more of the rated engine horsepower to the drive sprocket than any comparable power train . . . and parts and service are readily available to owners everywhere!

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Individual engine parts, such as pistons, rings, liners and connecting rods, are up to 72% less in cost than for more limited production engines . . . a fan-to-flywheel engine replacement costs only one-half to two-thirds as much in the C-6!

See a "EUC" C-6 at work and see the big difference that pays off in lower cost!



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DOES MORE WORK...and a better job on more kinds of work

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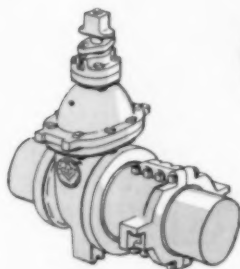
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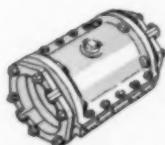
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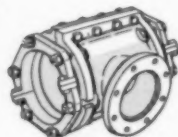
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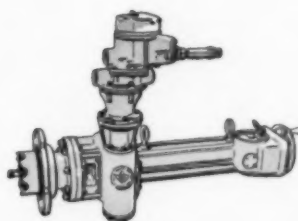
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Reflections on a reservoir

Here's how communities get fresh water and how commercial banks help

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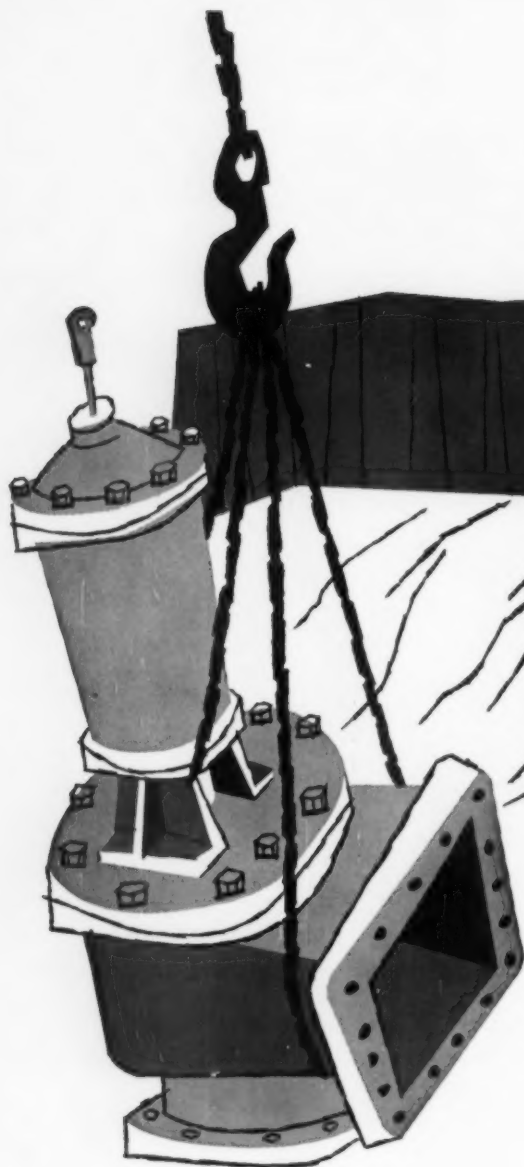


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Solving municipal and industrial water purification problems is a Roberts specialty. Our extensive engineering organization has—through the years—cooperated successfully with engineers and architects in designing the water purification plant best suited to each individual need. We would be delighted to furnish details.

Visit the Roberts Filter Booth 102 at A.W.W.A. Convention, June 4-9.

ROBERTS FILTER MANUFACTURING COMPANY
640 COLUMBIA AVENUE, DARBY, PA.

the nameplate of dependability . . .





One of Southern California's largest home developments, Eastgate, assures low-cost, efficient water service for its 2250 homeowners with "K&M" Asbestos-Cement Pressure Pipe.

22 MILES OF "K&M" ASBESTOS-CEMENT PRESSURE PIPE ASSURE dependable water service for a spanking new city of 10,000!



Modern cities like Eastgate spring full-grown from the earth—complete with homes, schools, shopping center and even a hospital. To make such a city a reality calls for modern methods and modern materials, such as "K&M" Asbestos-Cement Pressure Pipe. This rugged pipe was the builder's choice for its freedom from maintenance and for its durability. He knows today's particular home buyers demand mate-

rials that function without failure for years and years. Another important factor was the ease of installation and handling "K&M" Asbestos-Cement Pressure Pipe offers. Robert Kennedy, of Kennedy Pipe & Supply Company, tells you, in his own words, how "K&M" Asbestos-Cement Pressure Pipe helped him adhere to a tight schedule.



"THE 'K&M' FLUID-TITE® COUPLING HELPED US LAY MORE PIPE PER HOUR!"

"We had no trouble keeping up with the builder's tight schedule with 'K&M' Asbestos-Cement Pressure Pipe and the 'K&M' FLUID-TITE Coupling. All we had to do was lubricate the pipe end, and slide it into the coupling. This gave us a joint tight under all operating conditions. We didn't need any heavy machinery or coupling pullers. 'K&M' Pipe was lightweight and easy to handle, which permitted us to work smoothly. It reduced our installation time and costs considerably."



Robert Kennedy, President, Kennedy Pipe & Supply Company, Paramount, Calif.

After it's in the ground, "K&M" Asbestos-Cement Pressure Pipe is practically indestructible. It won't tuberculate. This assures the taxpayer of the same water flow and pressure years later, that he had when his home was new. Pumping costs remain low. Joints stay watertight. In addition, this pipe resists corrosion, and is immune to electrolysis.

For more information write to: Keasbey & Mattison Co., Ambler, Pa.



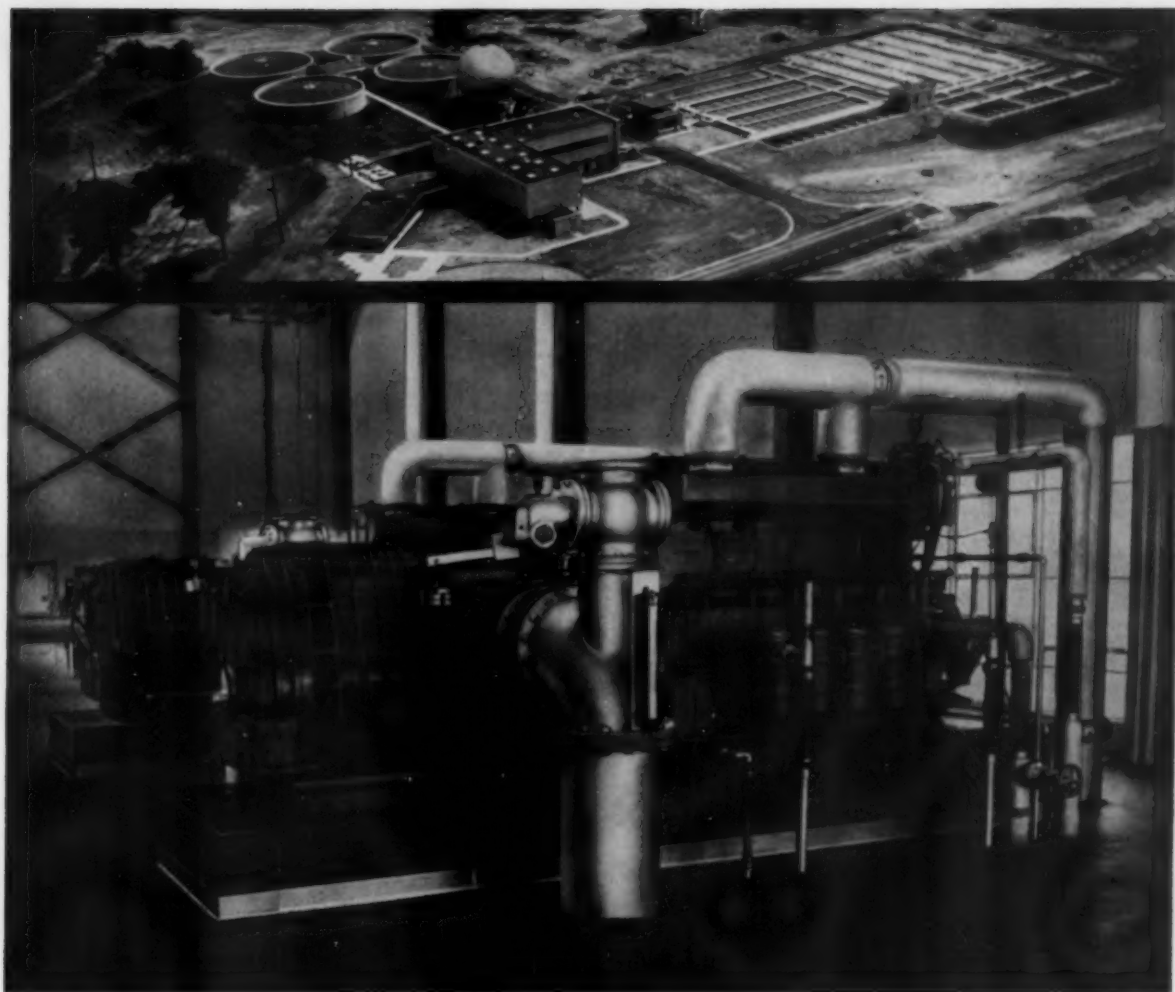
Keasbey & Mattison at Ambler

The light weight of "K&M"® Asbestos-Cement Pressure Pipe permits you to lay most sizes by hand... and reduces shipping costs.



Assembling the exclusive, patented "K&M" FLUID-TITE® Coupling and Pipe takes but an instant.





WHITE / SUPERIOR ENGINES OPERATE ON FREE SEWAGE GAS

at Hamilton, Ohio's 12,000,000 gallon per day sewage treatment plant

Two White Superior 6G-825 gas engines at Hamilton, Ohio's new activated sludge type sewage treatment plant are saving taxpayers thousands of dollars yearly. Engines operate on free sewage gas produced in the plant digesters. The Superiors, each rated 300 bhp at 690 rpm, drive blowers with a total capacity of 14,000 cfm to aerate sewage. Heat from engine cooling water also helps heat the buildings.

Superiors also feature outstanding design simplicity, with fewer moving parts than comparable power units. Maintenance and repair costs are minimized, and re-

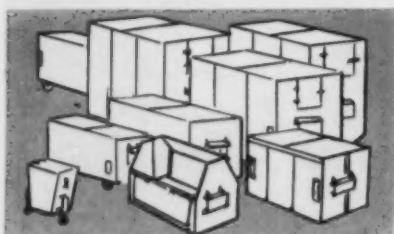
placement parts are seldom needed, even after extremely long periods of operation.

White Superior covers every municipal power requirement with a complete line of dependable diesel, dual-fuel and gas engines, 190 to 2150 hp, or 150 to 1500 kw. *Write for literature today!* WHITE DIESEL ENGINE DIVISION, Springfield, Ohio.



White Diesel

America's Leading Line of Mechanized



DUMPMaster Containers are available with or without casters, ranging from $\frac{1}{2}$ through 8 cu. yd. capacity.



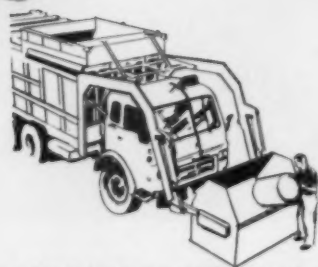
THREE SIZES AVAILABLE

The DUMPMaster is available in three sizes — 20, 24 and 30 cu. yd. bodies. Safe clearance arms that clear the cab doors are available in capacities of 1,500, 3,000 and 6,000 pounds.

This safe, efficient, self-loading packer is equally at home on containerization or manual collection routes.



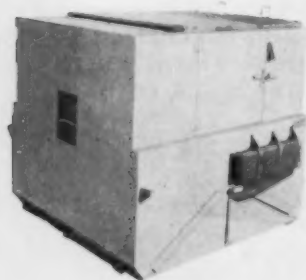
FREE BROCHURE
Catalog Section 10



DUMPMaster

The SUPER DUMPMaster-DUMPMaster

The SUPER-DUMPMaster handles converted DUMPMaster Containers up to 12 cu. yds., and all DUMPMaster Containers through 12 cu. yds. Owners of DUMPMaster equipment may secure low-investment conversion kits to adapt their old containers for use with this new system.



FREE BROCHURE
6073-A

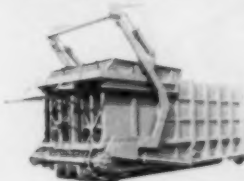
Refuse Storage and Collection Equipment

With its tilting skid frame and hydraulic lifting action, the DINOSAUR handles loads limited only by the capacity of the truck. Containers handled range from 8 cu. yds. to 40 cu. yds. and over. It is ideal for transfer-station use and for handling ash in incinerator operations.

DEMPSTER DINOSAUR®



**FREE
BROCHURE**
Catalog Section 12



The DEMPSTER-DINOMASTER used with Dinosaur



DINOSAUR picks up DINOMASTER body preparatory to leaving on refuse pick-up route.



DINOMASTER engages loaded container and begins emptying cycle.



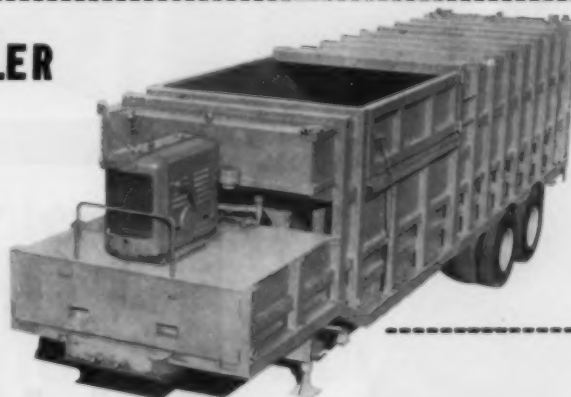
Dinosaur picks up 40 yd. refuse container



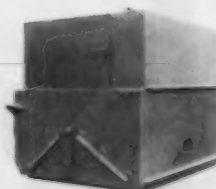
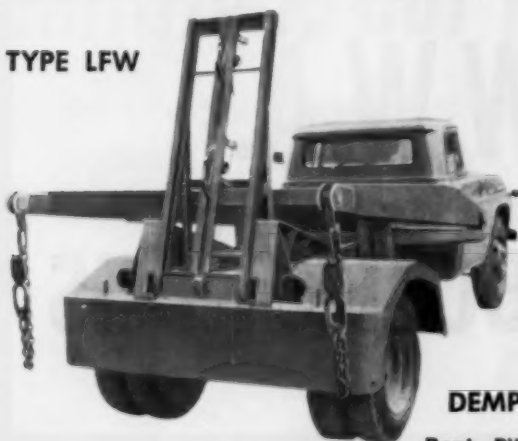
Thirty yard refuse container being loaded by GRD 304-F2

DEMPSTER Compaction TRAILER

This DEMPSTER development is providing highly efficient transfer-station performance in major cities from coast to coast. It can be used with a GRD for ground loading, or ramp-loaded by conventional packers and DEMPSTER-DUMPSTER LFW models. Sizes available are 42 and 53 cu. yd. capacity bodies, which carry the equivalent of up to 200 cu. yds. of uncompacted material on each trip to the disposal area.



TYPE LFW



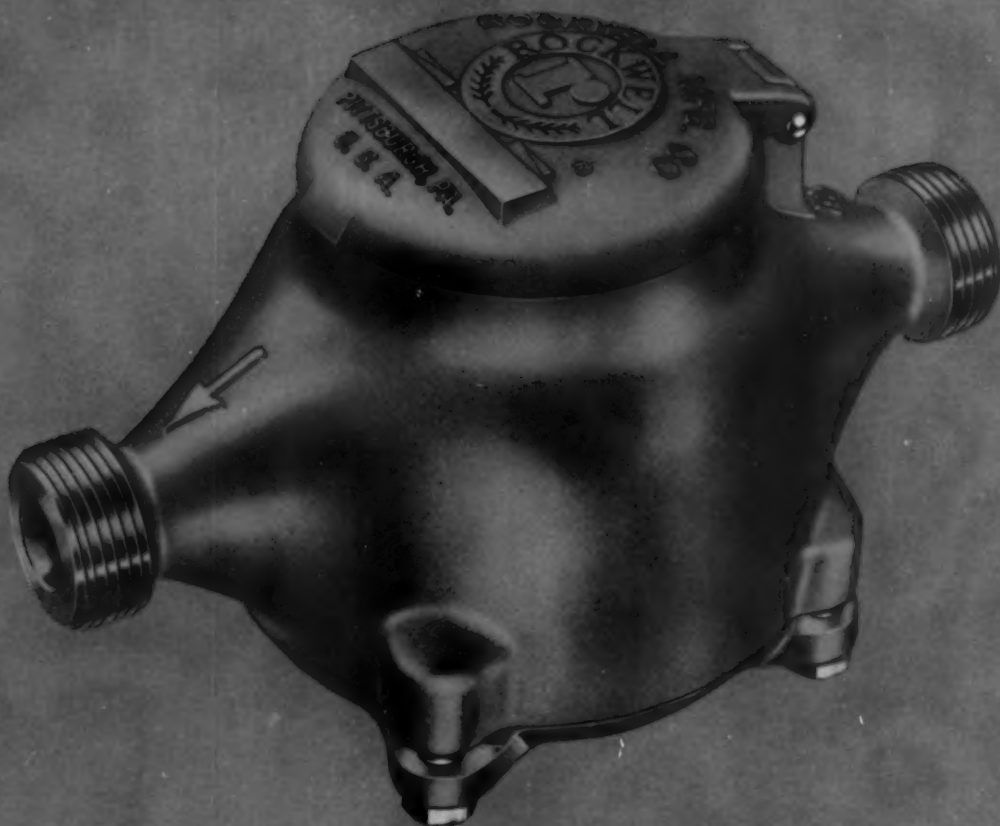
Still highly popular and efficient for short-haul container service is the DEMPSTER - DUMPSTER Type LFW. One man, the driver, and one DUMPSTER can handle a large number of big-capacity containers each day. Seven basic models are available, with payloads ranging from 6,000 to 38,000 lbs.

DEMPSTER BROTHERS
Inc.
Dept. PW-6, Knoxville 17, Tenn.

ALL A PART OF THE
DEMPSTER
SYSTEMS



**Conforms to
A.W.W.A.
Specifications**



Rockwell Sealed Register* "Magnetic" Meters *Imitated, but never equalled!*

For prompt shipment from warehouse stocks contact
Rockwell Manufacturing Company, Dept. 162F, 400 N.
Lexington Ave., Pittsburgh 8, Pa. In Canada: Rockwell
Manufacturing Company of Canada, Ltd., Box 420,
Guelph, Ontario.

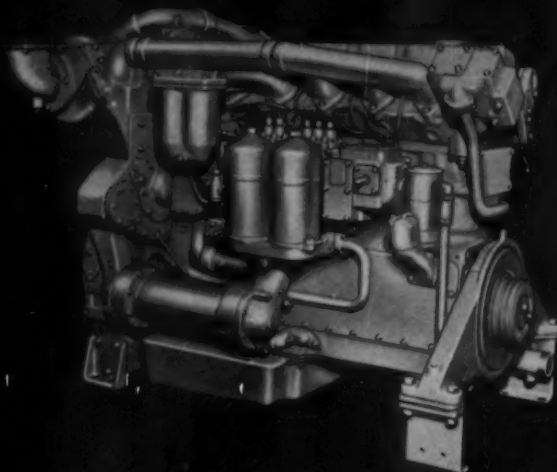
*Trademark



engine power

BY CATERPILLAR

FOR ORIGINAL POWER
OR REPOWERING
... PROFITABLY



SHOVELS, CRANES, BACKHOES



Dependable, high output Caterpillar Engines power excavators with 3/8 to over 9 cu. yd. capacities.

PORTABLE AIR COMPRESSORS



Portable air compressors utilize Cat Engines' favorable power to weight ratio for steady dependable production.

BITUMINOUS PAVERS



Cat Diesels can burn low-cost furnace oil... another reason so many owners standardize on these engines.

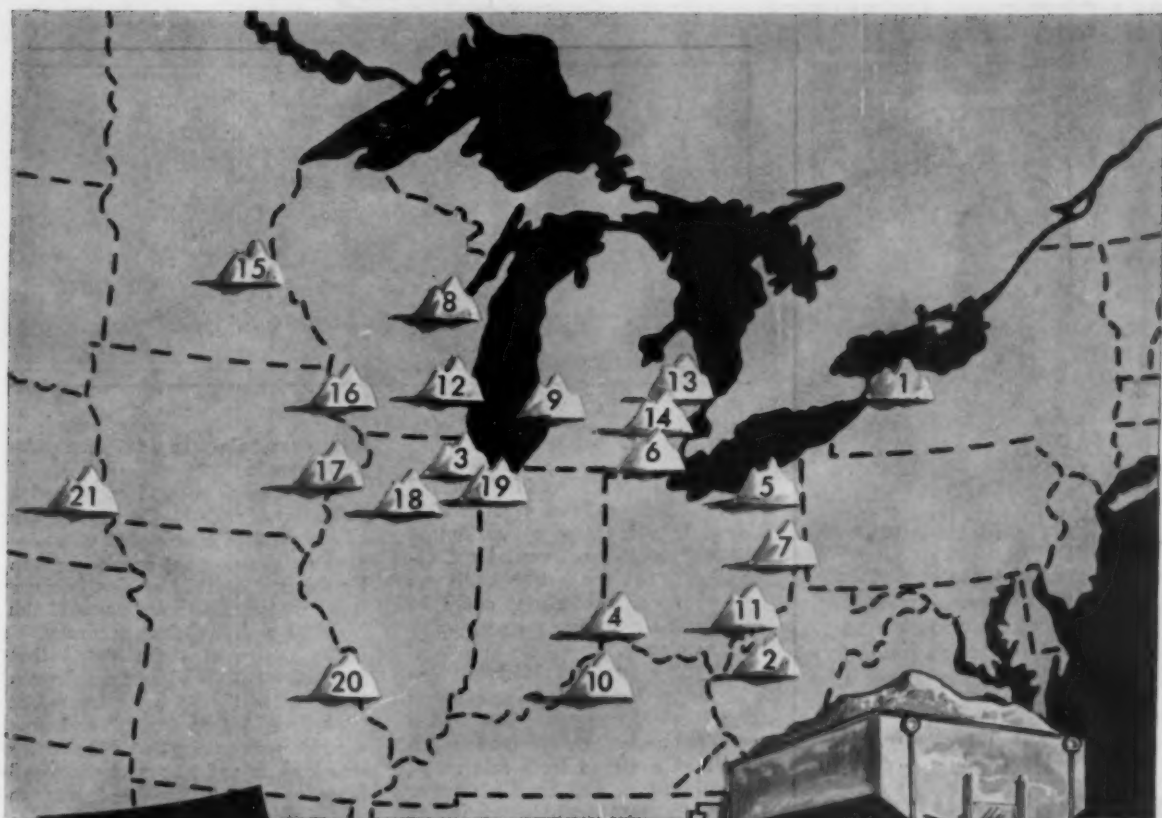
More heavy construction machinery is powered by Caterpillar than any other diesel manufacturer. The new D343 Diesel Engine (shown above) is typical of Caterpillar's advanced design. It weighs in at only 9.9 pounds per horsepower and produces 420 HP (maximum @ 2000 RPM equipped with jacket water aftercooler) —for standby electric service—250 KW.

There are tens of thousands of Cat Turbocharged Engines in use throughout the world. Their fuel systems require *no* field adjustments and no periodic overhauls. Your Caterpillar Dealer can prove Cat Diesels are best for original power... *and* repowering. See him today or write for information on Caterpillar Diesel Engines, Natural Gas Engines, and Diesel Truck Engines.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

Engine Division, Caterpillar Tractor Co., Peoria, Illinois, U.S.A.



NOW!

**DIAMOND CRYSTAL
SALT COMPANY'S**

NEW ROCK-SALT DEPOTS

offer fast, economical service for snow & ice removal salt



With storage depots strategically located (see keyed map) throughout the snow and ice belt, Diamond Crystal Salt Company can supply all your salt requirements in the shortest possible time. Be sure—play it safe—call your nearest Diamond Crystal sales office for fast service.

- | | | |
|-------------------------|--------------------------|----------------------------|
| 1. Buffalo, New York | 8. Green Bay, Wisconsin | 15. Minneapolis, Minn. |
| 2. Charleston, West Va. | 9. Holland, Michigan | 16. Prairie du Chien, Wis. |
| 3. Chicago, Illinois | 10. Louisville, Kentucky | 17. Davenport, Iowa |
| 4. Cincinnati, Ohio | 11. Marietta, Ohio | 18. La Salle, Illinois |
| 5. Cleveland, Ohio | 12. Milwaukee, Wisconsin | 19. Michigan City, Ind. |
| 6. Detroit, Michigan | 13. Port Huron, Michigan | 20. St. Louis, Missouri |
| 7. East Liverpool, Ohio | 14. St. Clair, Michigan | 21. Omaha, Nebraska |



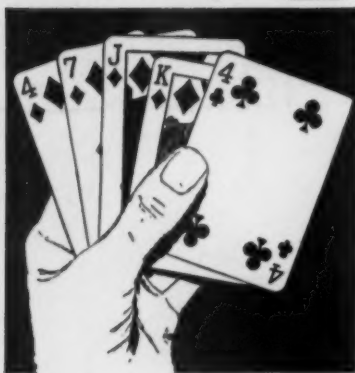
Diamond Crystal Salt Company

ST. CLAIR, MICHIGAN

75th Anniversary 1886-1961

PLANTS: AKRON, OHIO; JEFFERSON ISLAND, LA.; ST. CLAIR, MICH.
SALES OFFICES: AKRON • ATLANTA • BOSTON • CHARLOTTE • CHICAGO
DETROIT • LOUISVILLE • MINNEAPOLIS • NEW ORLEANS • NEW YORK

POKER? Play to win!



How would you play this hand?

One chance in five to fill this flush, so be sure the pot is at least five times as big as the bet. If you haven't passed openers, raise. In general, a timid "calling" game is a losing game. Play percentages, but push them hard.

Here's a sure winner from FORD:

Latest addition to the world famous Fordson diesel line of tractors—the new Fordson Super Major. New disc brakes, differential lock, comfort seat and many other new features give a new peak in Fordson performance.

Still the same reliable engine, however—the dependable 42.6 drawbar H.P. engine which has earned a reputation for fuel economy unmatched by any other engine in its class.

Fordson Dexta Diesel tractor is better, too. Improved hydraulic system, transmission and styling make it a better buy than ever before. Get details from your Ford Tractor Dealer, or write:

**Tractor and Implement Division
Ford Motor Company
Birmingham, Michigan**



LEGAL ASPECTS OF PUBLIC WORKS

MELVIN NORD, Dr. Eng. Sci., LL.B.

Use of Public Land

Abolt v. City of Fort Madison, 108 N.W. 2d 263, an Iowa case decided March 7, 1961, raised a question as to whether land reserved by Congressional Act for public highways and for other public uses could be used by the city for a purpose other than as a park.

The City of Fort Madison was laid out and platted in pursuance of an Act of Congress of 1836 which set aside certain public land which "shall be reserved from sale . . . , for public use, and remain forever for public use, as public highways, and for other public uses." A portion of such land, consisting of 2.2 acres of Riverview Park, was leased by the city's dock board to the Caldwell Co., for the purpose of constructing and operating dock and warehouse facilities along the Mississippi River.

Plaintiff, a neighboring resident of the city, sought to restrain the city and the Caldwell Co. from proceeding under the lease. She complained specifically that the city had no right to lease the land for the storage of molasses as a public bonded warehouse. She complained that the lease was a mere guise under which the company intended to devote the leased ground to a private use.

The court held, however, that the land was in fact being subjected to public use. The court said that any use for which a public body, such as the dock board, may rightfully exercise the power of eminent domain is a "public use," and that the lease was not shown to be a subterfuge. The court therefore held for the defendants.

Sidewalk Defect

Russell v. City of Minneapolis, 107 N.W. 2d 711, a Minnesota case decided Feb. 3, 1961, was an action against the city and another for

injuries sustained in a fall on a public sidewalk.

At the trial, plaintiff recovered a judgment for \$1200. On appeal, the city contended that statutory notice of the claim was not properly given by the plaintiff to the city, because it did not describe the place of the accident with sufficient accuracy.

The notice of claim stated that plaintiff was injured on the sidewalk "in front of the property located at 1029 Fourth Ave. South" and that the sidewalk in front of this address was broken and torn and contained large holes. Actually, the depression in the sidewalk which caused plaintiff's fall on Fourth Ave. was 6-15 feet north of the northwest corner of the building, in front of a garage or warehouse which had no entrance or street number at this point.

The court held that the notice of claim was sufficiently definite, and affirmed the judgment for the plaintiff.

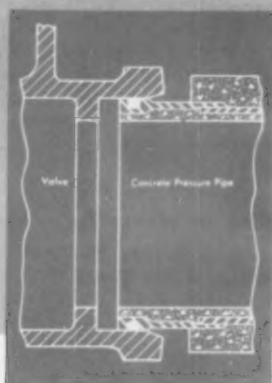
Improvement of Business District

Crampton v. City of Royal Oak, 108 N.W. 2d 16, a Michigan case decided Feb. 28, 1961, was an action by owners of land in a special assessment district challenging creation of the district for improving the city's business district, and challenging the assessments.

The project, as planned, included the improvement and enlargement of automobile parking facilities, the retiring of outstanding parking revenue bonds, the widening of certain streets, the opening of a new street, and the development of a pedestrian mall and plazas. The total cost was estimated at the sum of \$2,803,657.40. The resolution of the city commission provided for the establishment of a special assessment district comprising the property on which there was directed to be assessed, according to benefits,

HOW TO SAVE MONEY

Use M&H Hub-end, O-ring Valves for Concrete Pipe NO ADAPTERS NEEDED



Cross section drawing to show position of concrete pipe spigot entering the hub of valve.

Eliminating the need of adapters when installing a valve in a concrete pressure pipe line saves both the purchase price and the installation expense of adapters. For a large size valve this often amounts to hundreds of dollars. That is why water works management, engineers and municipal officials are welcoming the advent of a valve with special hubs for use with concrete pipe. This valve employs an O-ring gasket to connect the valve hub directly to the spigot end of the concrete pipe. It was developed and now is manufactured by M&H Valve and Fittings Company.

This new valve for concrete pipe meets AWWA standards in every respect and is furnished in sizes 12" through 42". The valve gaskets are the same as the gaskets used for concrete pipe joints. For additional information, write for illustrated descriptive Circular No. 26.

M&H VALVE
AND FITTINGS COMPANY
ANNISTON, ALABAMA





**Reliable, cost-saving
independent power...**

Kohler Electric Plants

Kohler electric plants have proved their rugged efficiency on new turnpike construction, building projects—wherever reliable power is needed for floodlights, power tools. Engineered for fast, all-weather starting, round-the-clock stamina on tough schedules where time means money . . . Sizes to 115 KW, gasoline and diesel, include compact, 4-cycle, air-cooled models . . . and emergency models for toll plazas, maintenance buildings when storms or accidents cut off normal power source . . . Write for folder L-29.

KOHLER CO. Established 1873 KOHLER, WIS.



MODEL 5RM61,
5000 watts, 115/230
volt A.C. Remote start.

**KOHLER
ELECTRIC
PLANTS**

KOHLER OF KOHLER

ENAMELED IRON AND VITREOUS CHINA PLUMBING FIXTURES • ALL-BRASS FITTINGS
ELECTRIC PLANTS • AIR-COOLED ENGINES • PRECISION CONTROLS

the sum of \$2,660,526.04. The balance of \$143,131.36 was directed to be apportioned to the city at large.

The area involved in the project is approximately six city blocks from east to west, and seven blocks from north to south. Embraced in it is the central business district of Royal Oak. The various improvements sought to be combined to accomplish the desired result are claimed by defendant city as necessary to carry out the purpose of the project.

The court held that the project was within the powers of the city (but that certain portions of the assessments could not be sustained).

Open Manhole

Francke v. City of West Bend, 107 N. W. 2d 500, a Wisconsin case decided Feb. 7, 1961, was an action for personal injuries sustained by a pedestrian who fell into an open sewer manhole in a street.

The court held that there was no liability in this case on the theory of nuisance because this was a governmental function. (This is not in accord with the weight of authority in other states.) However, the court held that if the facts alleged were shown, there would be liability under the statute relating to defects in a highway.

• • •

Training in Water Examination

A 1-week course, Recent Developments in Water Bacteriology, will be presented July 24-28 by the Robert A. Taft Sanitary Engineering Center, Cincinnati, for professional bacteriologists and others in positions of responsibility in state, municipal, and other laboratories engaged in bacterial water analysis. Lectures, discussions, demonstrations and laboratory sessions cover the study of coliform bacteria as indicators of fecal pollution; methods of detection and enumeration; and develop skill in membrane filter techniques. Fecal streptococci are studied in detail. Applications and/or information from Chief, Training Program, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 26, Ohio.

Rubbish Collection Along Michigan Highways

The Michigan State Highway Department Maintenance Division estimates that highway maintenance crews collected almost 17,000 tons of rubbish and debris along Michigan's highways in 1960.

PUBLIC WORKS for June, 1961

P & K OUTDOOR LIGHTING REPORT

the Modern Trend in LOW LEVEL LIGHTING



modern lighting at a realistic cost

Here are two contemporary outdoor lighting installations — one an all new municipal swimming pool and recreational area — the other, a prominent New Jersey University. Both chose the P&K all aluminum CIRCLElux lighting package to illuminate and compliment their roadways, walkways, landscape and architecture.

The sweeping lines of the P&K CIRCLElux davit blend with the modern one story architecture of the Rath Park Swimming Pool. Yet, the modern, but stately, design of the P&K CIRCLElux post is in good taste with the traditional architecture of Fairleigh Dickinson University. The CIRCLElux lighting package is the correct low level lighting choice to compliment almost all types of architecture.

The P&K CIRCLElux is available in a wide range of davit styles and mounting heights. The post is available in one basic design but at various mounting heights and with the CIRCLElux you have a choice of three light sources — incandescent, mercury vapor and fluorescent. This combination of luminaires and davits or posts will enable you to specify "packaged" lighting units. This means easier specifying by using matched components which in turn can customize your lighting projects.

Send in your reservation now for the new CIRCLElux catalog.



TOP PHOTO: Location: Rath Park, Franklin Square, L. I., N. Y.
Architect: Herbert D. Phillips

Consulting Engineers: Barstow, Mulligan & Vollmer

LOWER PHOTO: Location: Fairleigh Dickinson University, Madison, N. J.
Electrical Consultant: H. L. Sykes



P&K

PFAFF & KENDALL 84 FOUNDRY ST., NEWARK 5, N. J.

BRANCH SALES OFFICE: SAN JOSE, CALIFORNIA

IN CANADA: POWERLITE DEVICES, LTD., TORONTO, MONTREAL, VANCOUVER

EXPORT REPRESENTATIVE: PHILIPS EXPORT CO., NEW YORK, N. Y.

BISMARCK, N. D. Modernizes and Enlarges its Filter Plant with INFILCO Equipment



INFILCO INC.
General Offices:
TUCSON, ARIZONA

Field offices throughout
the United States
and in other countries

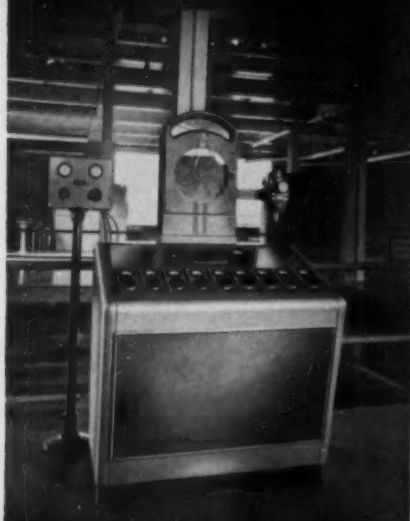
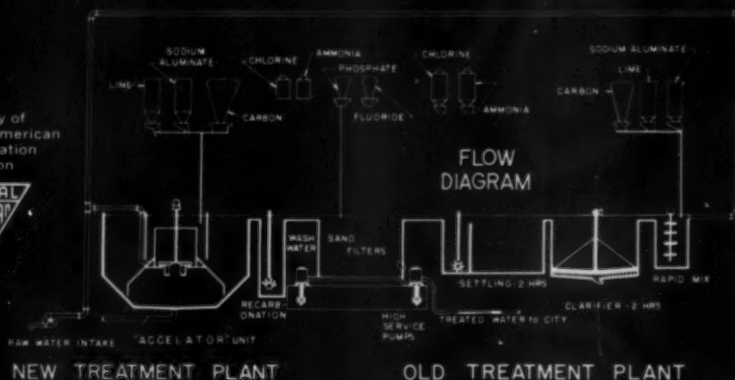
Subsidiary of
General American
Transportation
Corporation



In 1942, the City of Bismarck doubled the size of its water treatment plant to a capacity of 4.5 MGD to clarify, soften and stabilize Missouri River water. In 1958 the industrial and municipal expansion of the city required a further 100% expansion of the plant to satisfy current needs. Future demand was estimated and the Consulting Engineers for the city designed a new plant with a capacity of 6 MGD.

The new plant includes a single ACCELATOR® unit, INFILCO meters, "TWIN THROAT" venturi tubes, Chemical Feeders and VISCOMATIC® slaker, C.-A.-P. SYSTEM® filter controls, a Type "P" Recarbonator and three nine-valve INFILCO filter operating consoles.

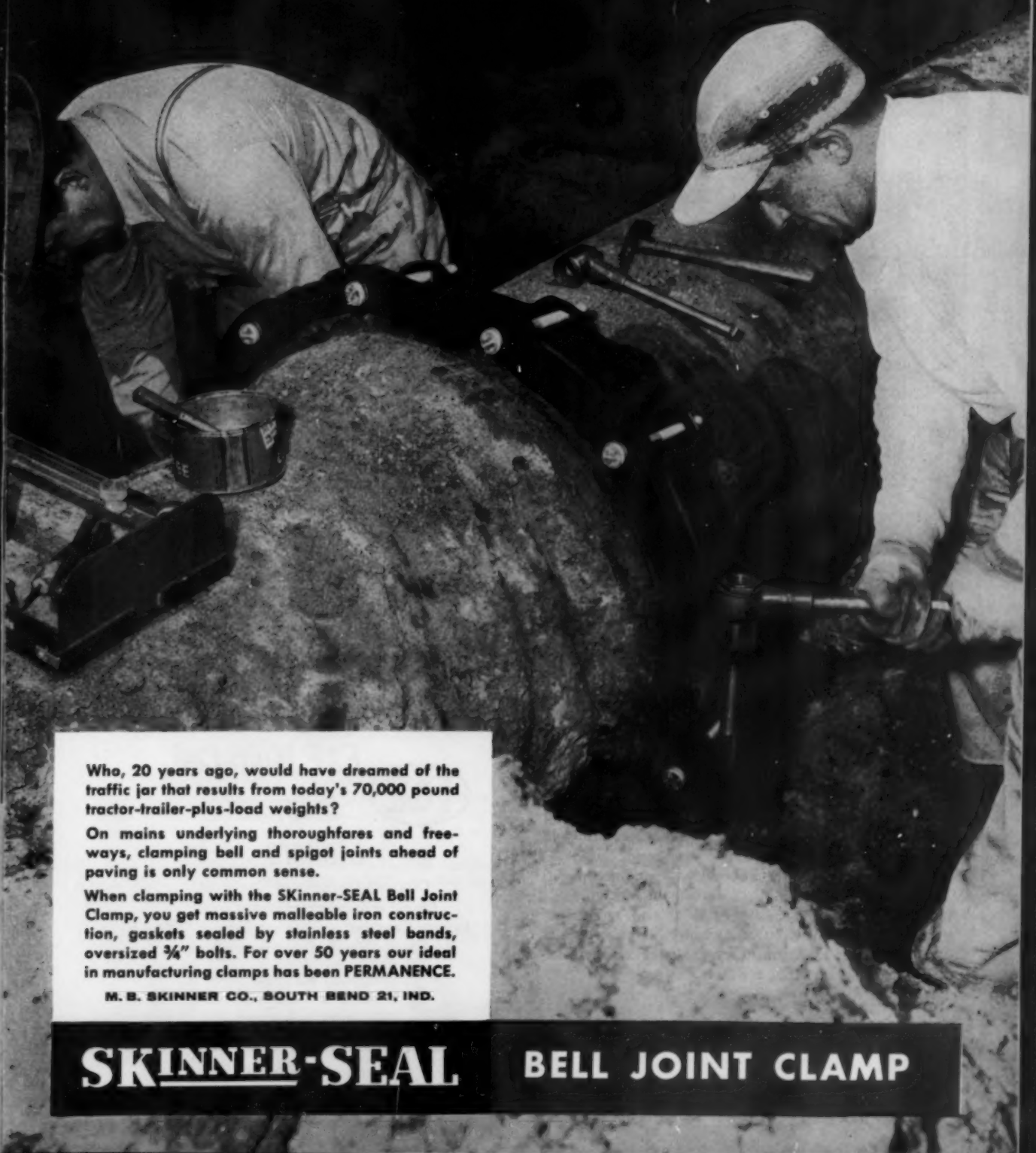
As part of the project, the old plant was also modernized by the conversion of hydraulic filter control equipment to pneumatic operation with automatic shut-off from clearwell level using six new C.-A.-P. SYSTEM consoles, INFILCO Loss-of-Head and Rate-of-Flow converters, controllers and gauges.



Consulting Engineer
L. W. Burdick
Grand Forks
North Dakota
Plant Superintendent
William Yegen



CLAMPING AHEAD OF PAVING



Who, 20 years ago, would have dreamed of the traffic jar that results from today's 70,000 pound tractor-trailer-plus-load weights?

On mains underlying thoroughfares and free-ways, clamping bell and spigot joints ahead of paving is only common sense.

When clamping with the SKinner-SEAL Bell Joint Clamp, you get massive malleable iron construction, gaskets sealed by stainless steel bands, oversized $\frac{3}{4}$ " bolts. For over 50 years our ideal in manufacturing clamps has been PERMANENCE.

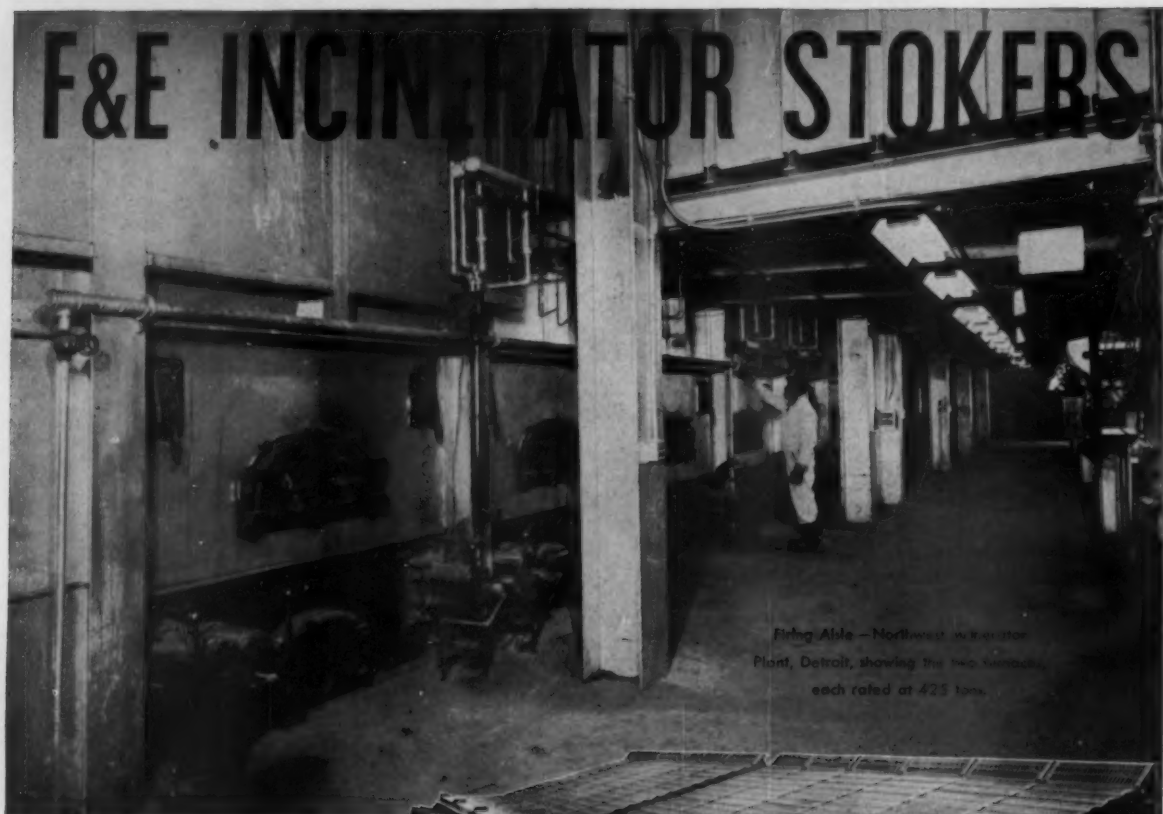
M. B. SKINNER CO., SOUTH BEND 21, IND.

SKINNER-SEAL

BELL JOINT CLAMP

DETROIT to install TWO MORE

F&E INCINERATOR STOKERS



Firing Aisle—Northwest Incinerator Plant, Detroit, showing the two stokers, each rated at 425 tons.

TOTAL CAPACITY WILL BE INCREASED TO 3,000 TONS OF MIXED REFUSE DAILY

Seven F&E Multi-Cell Incinerator Stokers, with a total rated capacity of 2,325 tons of mixed refuse daily, are already in use in the various plants in the City of Detroit. Operating experience shows that all units easily exceed their nominal rating in normal operation, resulting in substantial savings to that city.

When additional incinerator capacity was required, F&E Multi-Cell Incinerator Stokers were again selected.

According to Mr. Theodore E. Winkler, Engineer of Waste Disposal, the City of Detroit will have a total rated capacity of 3,000 tons when the two F&E Incinerator Stokers now on order are installed.



Specify F&E Multi-Cell Incinerator Stokers

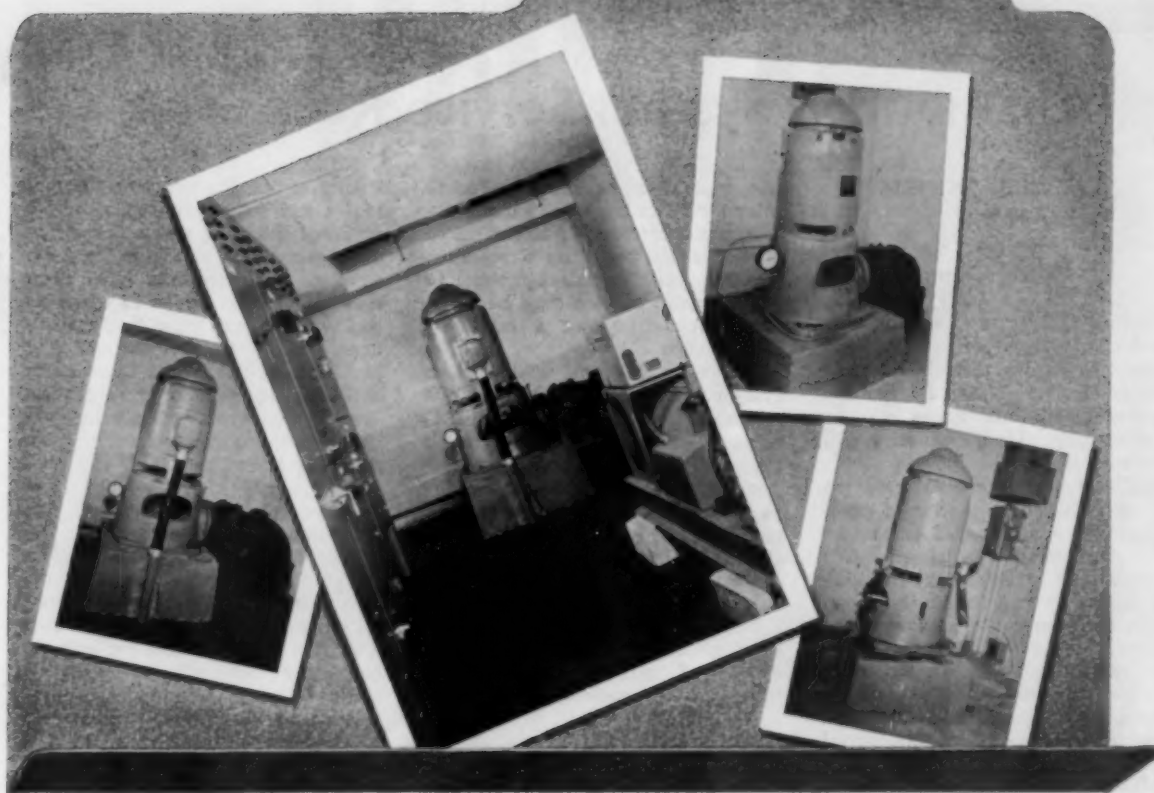
*Complete Flexibility of Operation
Utmost in Economy—Reduced Labor
Rugged Construction—Lifetime Dependability
Progressive Burning for Maximum Results*

CONTACT F&E TODAY
for engineering details and data.

FLYNN & EMRICH

BALTIMORE 2, MARYLAND

THE MAHWAH CASE



DEMING TURBINES at work . . . 4
Total years on the job 28
Maintenance required 0

Consider this when you begin planning expansion or replacement of your pumping facilities:—Four DEMING Turbine Pumps at the modern public water works of Mahwah, New Jersey, have been on the job steadily since 1953—without a single service need.

Rated pump capacities: 1400 G.P.M., 600 G.P.M., and two at 800 G.P.M. Drive: electric motor; with diesel auxiliary for the 125 h.p., 1400 G.P.M. pump. Discharge pressure: 80 pounds. Pumping level in wells: 100 feet from surface.

Simple design—low maintenance

Widely known for their simplicity of design, and engineered to handle both emergency and normal demands smoothly, DEMING Turbine Pumps have established an enviable record of low maintenance cost.

What are your specifications? DEMING Turbine Pumps will meet them. Write for Bulletin 4700 and the location of the DEMING installation nearest you. Address—

MAINTENANCE RECORD—DEMING PUMPS

Year	Pump #1	Pump #2	Pump #3	Pump #4
1953	none	none	none	none
1954	none	none	none	none
1955	none	none	none	none
1956	none	none	none	none
1957	none	none	none	none
1958	none	none	none	none
1959	none	none	none	none
1960	none	none	none	none

THE DEMING CO.
 693 Broadway • Salem, Ohio

Please send me full information on the complete line of DEMING pumps for municipal service.

NAME _____
 ADDRESS _____
 CITY _____ ZONE _____ STATE _____

Distribution System Service Reliability

BRUCE J. ENNIS

Associate,

Burns & McDonnell Engineering Co.,
Kansas City, Missouri

CONSUMERS on present day electric distribution systems have learned to depend heavily on continuous electric service. As systems grow and additional usage is made of electricity, this dependence will increase.

While a momentary interruption of power may be a matter of small concern to a residential consumer, a lengthy outage can cause severe financial loss when factory machinery comes to rest in an industrial plant, and can cause inconvenience and even dangerous conditions when lighting systems, elevators and other electric services are disrupted in stores, office buildings, hotels, theatres, and other commercial enterprises.

Most municipal systems represent a large investment. Due to the need for tempering service reliability with economic justification, the normal system uses radial feeders on overhead pole lines, with only limited amounts of underground construction, and loop or network type of feeders, comparatively speaking.

With a radial feeder, trouble on the pole span adjacent to a supply substation will affect all of the consumers beyond that point, along the entire feeder section. If faults occur farther out along the feeder, only the consumers beyond the point of fault will be affected, provided the system is provided with sectionalizing breakers, oil circuit reclosers, or fuses to isolate faults to relatively limited areas.

Obviously, any system may be designed, operated, and maintained to achieve continuity of service in higher degree than presently available; however, the investment required for necessary improvements could far outweigh the advantages to be realized, and could lead to an increase in electric service rates which would be prohibitive. In planning improvements primarily for improved service reliability, it is necessary to use good judgement; otherwise, an essentially trouble-

free system might require electric rates far in excess of consumer acceptance. Fortunately, if corrective measures are made on a selective basis, appreciable improvements in continuity of service may be made for most systems at a relatively modest cost.

For example, one mid-western system has been able to improve reliability markedly by using shielded construction on all 13.8 kv main feeder pole lines to step-down substations, resulting in better service to thousands of consumers. For economic and practical reasons, such shielded construction is not used on short 13.8 kv spur pole lines feeding only a relatively few consumers.

The principal areas for improving service reliability lie in better operations and maintenance practices, improved system designs, and better sectionalizing practices. In the interest of economy, increasing the operation and maintenance activity, (such as accelerated tree trimming programs) in a small percentage of the main feeder sections will yield big dividends in reliability. Improvement in system design is a long range proposition requiring planning by which the system can be developed with more reliable designs at comparatively little extra expense. By judicious application of sectionalizing devices in conjunction with the existing protective scheme, considerable improvement in reliability may be gained with relatively low cost, low maintenance devices.

With regard to improved public relations and overall consumer satisfaction, improvements in service reliability should be geared to a study of past consumer complaints and outage records, coupled with a study of the corresponding number of miles of exposure and number of consumers served by various line sections, together with the number of outages per mile per year. Such improvements should be initiated for line sections yielding the maximum benefit to the largest number of consumers.

Individual systems will experience problems peculiar to their geographical location. One system in Louisiana, where severe lightning and thunderstorms are common, experienced approximately 200 trip-outs per

100 miles per year on conventional 15 kv unshielded construction. By applying shielding and other lightning protection measures to such circuits, such trip-outs have been reduced to from 1½ to 15 trip-outs per 100 miles per year. Such measures would not be economically justifiable in the Pacific Coast areas of the United States, where lightning disturbances are relatively insignificant. Where such static wire shielding is contemplated, the necessary cost for new pole line construction might be expected to run only one-third as much as for the conversion of existing pole lines to shielded construction.

In sections of cities where heavy foliage is present, and where tree trimming is impractical for esthetic or other reasons, consideration might be given to the use of suspended aerial cable for improved service continuity. Such cable is not subject to usual short circuits and grounds resulting from tree limbs falling across the line or from wires whipping together during windstorms, as might be expected with open wire construction.

Generally speaking, an improvement in operation and maintenance practices will do more to reduce consumer outage time than most other measures which might be taken, and such practices can be undertaken in a comparatively short period of time at relatively small cost. Such practices might contemplate improved tree trimming, pole inspection programs to prevent the lengthy outages that occur from pole failure, relatively frequent inspection and maintenance of circuit breakers and reclosers in severe duty locations such as at or near the source substation or power plant, replacement of types of insulators susceptible to puncture, and replacement of poor quality or types of connectors which cause frequent line burn down. Obviously, in no case should unsafe practices be used in order to speed up the repair or replacement time of system components.

Service reliability on many systems is influenced by occasional lengthy outages from widespread storm damage or source failure. To provide against such contingencies,

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systems sometimes prepare in advance emergency plans or courses of action to be followed in such events, with working agreements in effect with neighboring utilities or contractors for outside help in the form of additional man power and repair equipment to augment normal system forces in times of disaster. A mobile trailer-mounted spare transformer or substation of suitable characteristics offers a worthwhile facility for emergency service in the event of failure or necessary maintenance on an existing fixed substation.

In planning system extensions for additional expansion and capacity, improved reliability may be incorporated into the system by laying out adjacent radial feeders in such an arrangement that one feeder may serve to back-feed another feeder as an emergency source of supply through a local or remotely controlled load break tie-switch. Reducing distribution feeder length by installing additional substations is a method commonly used to improve service continuity at the time system capacity is being increased. For very important loads, such as a large industrial plant, dual feeders over separate pole lines provide a normal as well as an emergency source of supply for greater reliability, and large blocks of concentrated commercial load in a downtown area might justify the investment necessary for an underground network system with multiple supply routes.

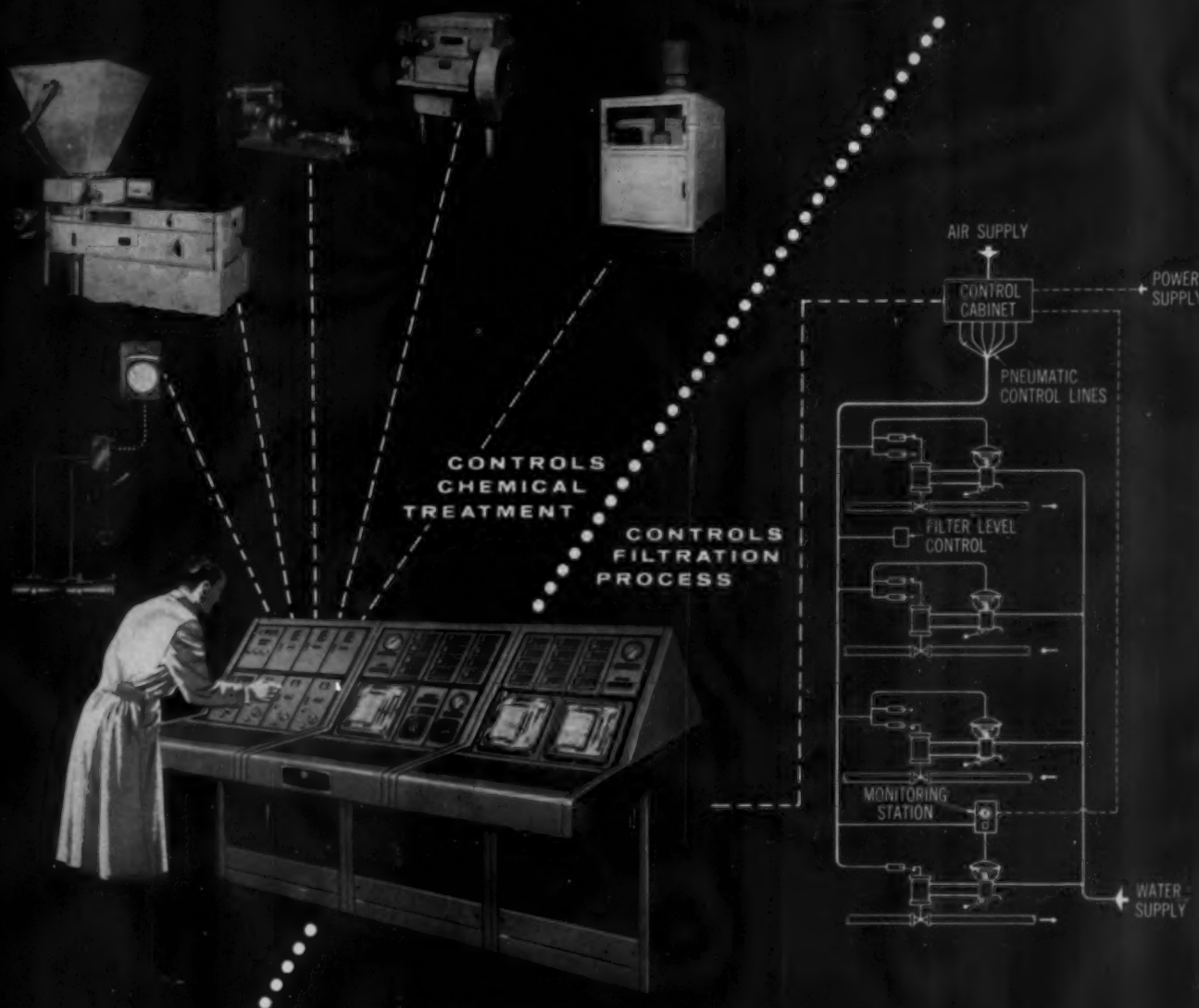
Sectionalizing of a radial feeder will greatly reduce the annual number of consumer outages. Major improvement will be experienced in long feeders by the application of three or four circuit breakers or reclosers installed in series along the feeder, beginning at the substation. Additional improvement in lesser degree may be expected by the installation of extra sectionalizing devices within the limits of successful coordination for selective tripping. Long taps branching off from the main feeder should be sectionalized to reduce the exposure on the trunk feeder and thus improve service continuity.

In all considerations of possible system improvements for increasing the reliability of service, there are two major principles. These are:

1. The design which will yield the minimum number of consumer-outages per year will give the most reliable system.
2. The design must be economical and be within the means of the consumers.



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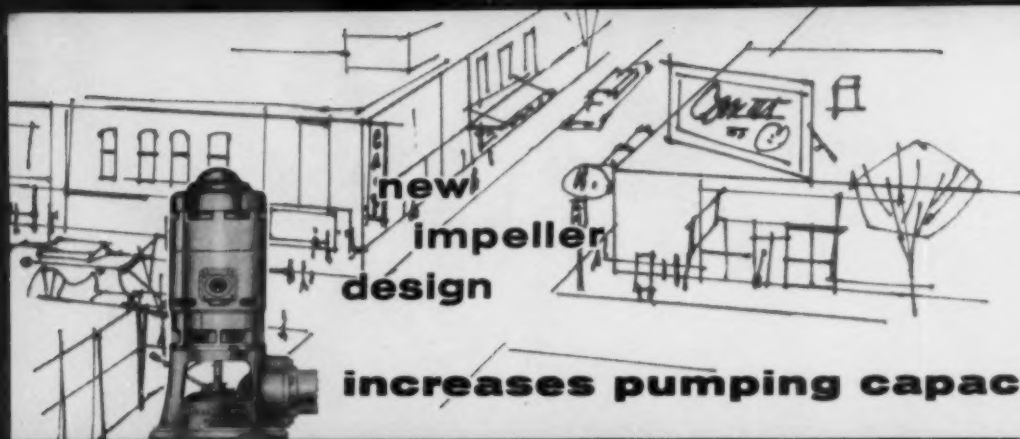
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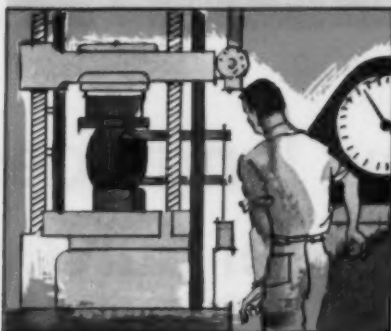
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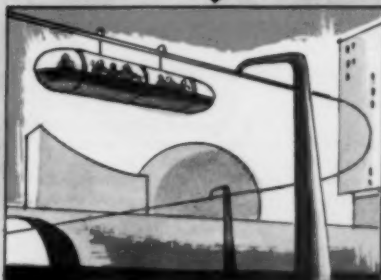
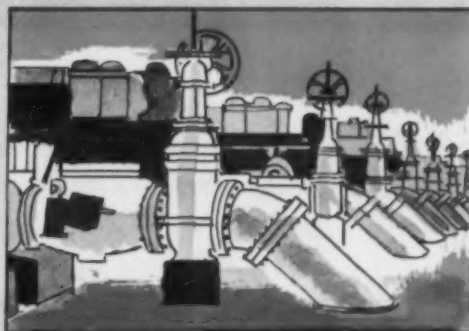
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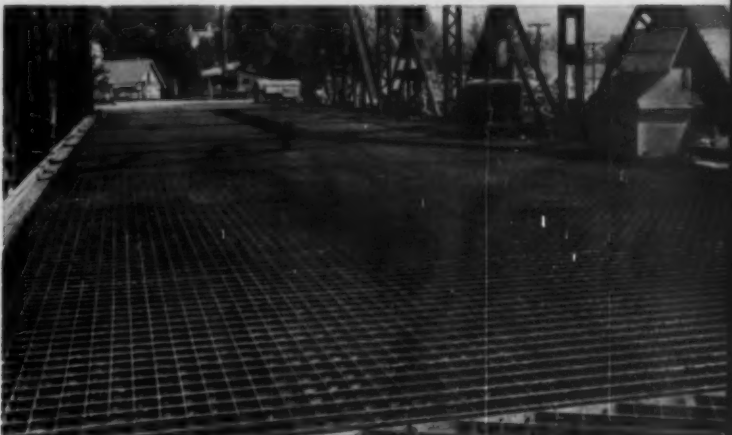
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The World's Largest Water Filtration Plant

PUBLIC
WORKS
MAGAZINE

Vol. 92, No. 6

JUNE, 1961

GEORGE S. SALTER

Chief Filtration Design Engineer, Department of Public Works, Chicago, Illinois

CRYSTAL CLEAR water for more than three million people is the goal of the designers of Chicago's Central District Filtration Plant.

The plant will be by far the world's largest filtration plant, having a rated capacity of 960 mgd at the nominal rating of 2 gpm per sq. ft. Hydraulically, it will be capable of handling up to 1700 mgd. The plant will serve the north two-thirds of the city of Chicago and some thirty communities west and northwest of the city.

The history of the plant extends back to 1926 when an experimental filtration plant was established on the south side of the city, with John R. Baylis in charge, to determine the best methods of treating Lake Michigan water. Studies made at that plant led to the construction of the South District Filtration Plant which was placed in operation in 1945; and data obtained on the operation of the South District plant has been used extensively in the design of the Central District Filtration Plant.

Planning of the Central District Plant began while the South District Plant was still under construction and extended to 1949 before the site of the Central District Plant was finally established by city ordinance. It was originally thought that two separate filtration plants would be required to serve the North and Central Water Districts. Extensive studies made on this subject, however, indicated that the construction of one plant at a central location would provide filtered water to both the Central and North Water Districts at much less overall cost than two separate plants. It was estimated that operating costs, including interest and amortization of both the centrally located plant and the connecting tunnel to the Wilson Avenue tunnel system, would be about \$140,000 per year less for a single plant. It was decided, therefore, to build one plant, to be known as the Central District Filtration Plant.

After the site of the plant had been established, extensive exploratory surveys were made to deter-

mine soil conditions at the plant site and also along the line of the tunnel to Wilson Avenue. These studies included the determination of the water depth at the plant site, the consistency of the underlying clay and the depth to rock. The depth to rock was checked by a supersonic survey made jointly with the U.S.G.S. These surveys indicated that the water depth varied from 10 to 22 feet, the underlying material consisting of clay varying from very soft to hard at increasing depth, and the depth to rock varied from 60 to 135 feet.

Foundations and Cofferdams

After a study of the consistency of the material at the plant site, three alternate types of foundations were considered. Comparative cost studies were made of raft, floating and timber pile foundations for the major plant structures. It was found that much of the soil, especially in the east half of the area, was of such soft consistency that a raft foundation would be excessively deep and expensive. A floating foundation could be used but it would be expensive to construct, and maintain in a dewatered condition so that there would be no probability of uplift. It was decided, therefore, to use timber piles for the foundations of most of the structures. It was estimated that piles between 40 and 50 feet in length could be used over most of the area, and, inasmuch as the tops of the piles would be below the permanent water line, untreated piles could be used.

The cofferdam required for dewatering the plant site was 1100 ft. wide and had an average length of 2,650 ft. It permitted the dewatering of 61 acres of the bed of Lake Michigan, 44 acres of which would be occupied by the plant substructures. Because of the consistency of the silty sandy clay over much of the area, more than 750,000 cubic yards of this material had to be removed in order to obtain a satisfactory foundation for the cofferdam walls. More than 900,000 cubic yards of sand were required as fill to replace



● GENERAL view, looking southwest, of the Central District Filtration plant as it appeared last October. Chicago business area in background.



● THREE engineers responsible for design and supervision of construction of the new plant are Dick Van Gorp, Chief Engineer; F. G. Gordon, Asst. Chief Engineer; and the author, all of the Engineering Bureau, Public Works Department, Chicago.

this material and bring the general elevation up to -11, the average elevation of the underside of the bottom slabs of the reservoir, settling basins and filter substructures.

The west wall of the cofferdam and most of the north and east walls were of the dike type, similar to that used successfully at the South District Filtration Plant, but the south wall and portions of the east and north walls were of cellular construction. The cells were constructed of interlocking steel sheet piling filled with stone. The south wall was of cellular construction to permit an unobstructed slip between the filtration plant and the north side of Navy Pier. This conformed with the U. S. Engineers requirements that provision be made for docking two 600-foot ships along this wall. The center portion of the north wall was of cellular construction because this part of the wall will be removed after the headhouse substructure is completed, thereby providing a direct shore intake for the plant.

Although the location of the plant at the site selected made possible short and economical tunnel connections to the Central Water District, the connecting tunnel to the Wilson Avenue tunnel system is some 5½ miles long and 16 ft. in diameter. With the other connecting tunnels at the plant and at Wilson Avenue, the cost will approximate \$15 million. It should be noted that one of these tunnel connections is being made at the Chicago Avenue shore shaft where provision was made in 1934

when the Chicago Avenue tunnel was constructed, for a future connection to a filtration plant which it was assumed would be built in that area. In a similar manner, provision for a future tunnel connection was incorporated in the design of the shaft near Belmont Avenue on the recently constructed 16-foot connecting tunnel so that, if and when needed, a connection can be made to that shaft.

Treatment Units

The filtered water reservoir was the first of the structures to be built within the cofferdam. This structure has an average width of about 480 feet, is 964 feet long, and with a depth of 20 feet, its capacity is approximately 69 million gallons.

It was designed as a monolithic structure with special attention being given to obtain continuous frame action in both directions. On account of the limited area within the cofferdam, it was assumed that subsequent contractors would use the roof of the reservoir for storage and plant use. The roof was therefore designed for a 250-pound live load and 8-ton axle load. The specifications required the contractor to place concrete in the floor, walls and roof in alternate panels approximately 4800 square feet in area, and to limit the length of any section to 70 feet. In addition, a minimum of 0.6 percent of temperature steel was used.

The reservoir is divided into two halves with the smaller north half providing water to the North Water

District and the larger south half providing water to the Central Water District. Under normal operating conditions, the water level in the north half of the reservoir will be maintained at elevation plus 8 (8 feet above mean lake level) and the excess water will flow through a series of openings in the dividing wall into the south half of the reservoir where it will augment the supply of water from the south half of the plant to the Central Water District. The greater depth of water in the north half of the reservoir will improve the hydraulic conditions in the Wilson Avenue tunnel system. The depth of the water in the south half will vary in accordance with variations between the filter rate and system demand but usually will not deviate more than a foot above or below the set point.

The construction of the filter and settling basin substructures followed closely after the reservoir. These structures cover an area of approximately 31 acres and are supported on 87,000 timber piles. Both structures are of the double decked type. The mixing basins occupy the first 80 linear feet of the settling basin area, with the remainder of the upper level and all of the lower level being used for settling. The clear wells, with a total capacity of 66 million gallons, are located under the filters.

The mixing basins are of the axial flow type consisting of four channels with slotted walls between the last channel and the upper level of the settling basins. Paddle type flocculators are used. The flocculators in the first channel are equipped with four arms whereas the flocculators in the other three channels have only two arms. Provision is made to operate the flocculators at peripheral speeds of approximately 1 or 1½ feet per second in the first channel and approximately 0.7 or 1.2 feet per second in the other three channels. The changes in speed will be obtained by interchange of sprocket wheels. Flow directional walls are provided in the first bay of the settling basin to improve uniformity of flow in the basins.

Sediment removal equipment is being installed in the upper level only of the settling basins. Provision has been made in the lower level for removal of sediment by flushing. A special flushing line with nozzles is being installed above the cross collector trench of the lower level to facilitate the removal of accumulated sediment at that level.

In normal operation of the plant, the sediment removal equipment

will be operated only about two hours each day and during this period the accumulated sediment will flow out to the lake through a special line connecting with the 84-in. wash water outfall. The sediment removal will be controlled by an adjustable overflow box at each settling basin.

Filter Design

The filters are of the dual type with two manifolds, each having filter effluent control and wash water valves, but with common influent and wash water drain valves. This arrangement permits the use of smaller effluent control and wash water valves but saves on the number of influent and drain valves. Each filter has a rated capacity of 10 mgd. The filter boxes are 13 feet in depth, considerably deeper than in most filter plants. The greater depth of filter box was selected in order to avoid air binding which might lead to overturning of the filter sand and gravel, and also to provide for a possible two-foot variation in the level of water in the filters and settling basins. It has been found by actual operating experience at the South District Filtration Plant that fewer changes in pumping rate are required if deviation between demand and filter rate can be taken care of by variations in the level of water in the settling basins and on the filters. This method of operation results in significant savings in costs of electrical energy because of reduction in demand charges.

The headhouse substructure occupies a 180-foot by 1100-foot central core area extending along the north-south axis of the plant between symmetrical groupings of 48 filters and 8 settling basins. The



● PLACING the cast iron laterals of the underdrain system. The capacity of each filter is 10 mgd, with box depth of 13 ft. to permit 2-ft. variation in water level.

structure provides the foundation for the Pumping, Chemical and Administration Building. The general arrangement of the plant is such that most of the facilities requiring the attention of the operating personnel will be located near the center of the plant. Data on all phases of the operation of the plant will be transmitted to a control center located near the intersection of the north-south and east-west axes of the plant. This center will be the point from which basic instructions will be issued for plant operation. Operating centers for filter and pump control and chemical feeding will be located nearby.

The low lift pump installation is located in the north end of this central core. These pumps take suction from individual pump pits and discharge into the dual raw water basins, one for each half of the plant. The pumps are of the vertical

mixed flow type which are exceptionally efficient for the 25.5-foot design head.

The plant drainage, dewatering and sediment removal pumps are located immediately south of the low lift pump area. Just south of this area are located the wash water and service pumps, air compressors, air storage tanks and attendant equipment.

The south half of the headhouse substructure is used for the receiving and storage of chemicals. The chemical receiving area has facilities for the delivery of chemicals by truck, rail or barge. The possibility of barge delivery of chemicals was one of the reasons for designing the south cofferdam wall as a dock. Four tracks are provided for rail service, one of them exclusively for chlorine. This track has two 100-ton scales which can be used for chlorine tank cars or for regular flat cars with the ton cylinders connected to a common manifold. Three of the tracks, including the track for chlorine, will be within the superstructure over the chemical receiving area. All receiving and unloading of chemicals will thus be within a protected area.

The chemical receiving tanks are located below the roadway and railroad tracks so that most chemicals can be unloaded directly into these tanks and then transferred to the storage tanks just north of the receiving area. Most of these tanks are of concrete with special linings as required for the particular chemical being stored. The storage tanks have a total capacity in excess of 3 million gallons.

Studies made at the South District Filtration Plant on the handling



● FILTER gallery view showing a 48-inch header with series of 30 by 42-inch reducing elbows in each of which is installed a 30-inch butterfly flow control valve.

Table 1—Partial List of Materials Used in Plant

Piles: Number	125,000
Length	5,900,000 lin. ft.
Concrete	515,000 cu. yds.
Reinforcing steel	80,000,000 lbs.
Cast iron pipe and castings (excluding filter underdrains)	2,900 tons
Steel pipe	950 tons
Miscellaneous metals	1,800,000 lbs.
Number of sluice gates (6 x 8-ft. to 8 x 10-ft.)	84
Filter underdrain piping (4-inch)	61 miles
Filter sand	38,000 tons
Filter gravel	26,000 tons
Wash water troughs: Number	2,304
Length	59,000 lin. ft.

and feeding of chemicals have shown that it is most efficient and economical to feed chemicals in the liquid or slurry form. The Central District Filtration Plant is therefore being designed to make the fullest use of handling chemicals in this manner.

Both alum and ferrous sulfate, the principal coagulating agents, will be used in the liquid state. Hydrofluosilicic acid and anhydrous ammonia will also be handled in this form while activated carbon and lime will be handled as slurries. Recent studies at the South District Filtration Plant have shown that the "plating out" of lime can be eliminated by maintaining lime slurry in the proper consistency.

Four Plants in One

For all practical purposes, the Central District Filtration Plant may be operated as one, two or four plants. The plant is divided along the north-south center line so that either half of the plant may be operated independently. Separate chemical application facilities are provided for each half, and the low lift pump layout is such that a group of four pumps will furnish water to each half. Provision is made in the raw water discharge basins for a cross connection if this is found necessary. Each half, in turn, is divided so that one quadrant, consisting of four mixing and settling basins, 24 filters and the necessary connecting conduits, can operate as a separate 240-mgd plant. This layout provides for great flexibility in operation.

The plant equipment is in keeping with the size of the plant. The low lift pumping equipment consists of six 260-mgd and two 170-mgd pumps. The pumps are driven by 1500 and 1000-hp motors respectively. Even with motors of this size, special provisions have to be made to depress the water level below the

impellers before the pumps are placed in operation. Using this method of operation, the 1500-hp load will not be exceeded and the pumps will operate at minimum possible heads.

Six wash water pumps, each of 20,000 gpm will be provided. Under normal conditions, three pumps will provide wash water for each half of the plant though the two 60-inch and 48-inch wash water headers which will be interconnected for flexibility of operation. A direct connection from these headers will be made to two 200,000-gallon wash water tanks riding on the line. They are located near the center of the plant at an elevation that will provide adequate head for both back wash and surface wash.

The wash water system is designed to back wash both halves of the filters simultaneously because, with the large number of filters involved (96), this will be necessary during periods of short filter runs. A separate 30-in. surface wash line connects directly to the wash water tanks. Rate-of-flow controllers are provided on both the back wash and surface wash lines.

The 30-in. surface wash header and all the back wash lines are of

steel. In general, lines 24-in. and larger are of steel and smaller lines are of cast iron. Exceptions include the use of a 30-in. concrete dewatering and drainage line and a 6-in. to 2-in. Transite flushing line in the settling basins where exceptionally corrosive conditions made the use of these materials advisable. Copper tubing was used where control or hydraulic cylinder operator lines had to be installed in concrete.

Rubber seated butterfly valves are being used extensively throughout the plant. To date 777 butterfly valves, from 14-in. to 108-in. have been furnished and are either installed or are in process of installation.

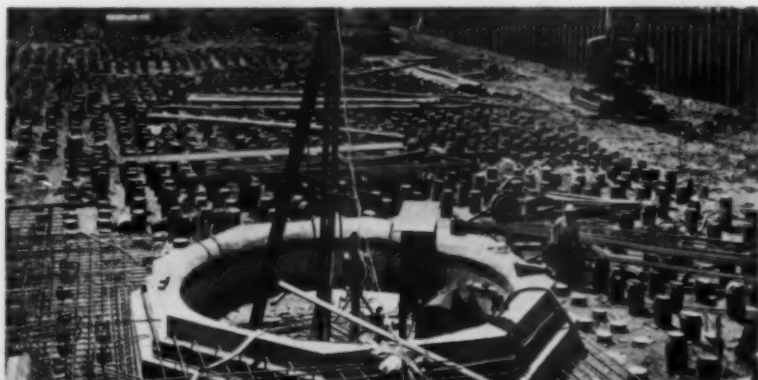
The filter underdrains are of cast iron. The filter medium consists of seven layers of graduated gravel with a total depth of 20½ inches, and 26 inches of sand with an effective size between 0.62 and 0.70 mm. and a uniformity coefficient between 1.3 and 1.5. This sand is essentially the same as that used successfully at the South District Filtration Plant where a satisfactory filtered water has been obtained with filter rates in excess of 5 gpm/sq. ft.

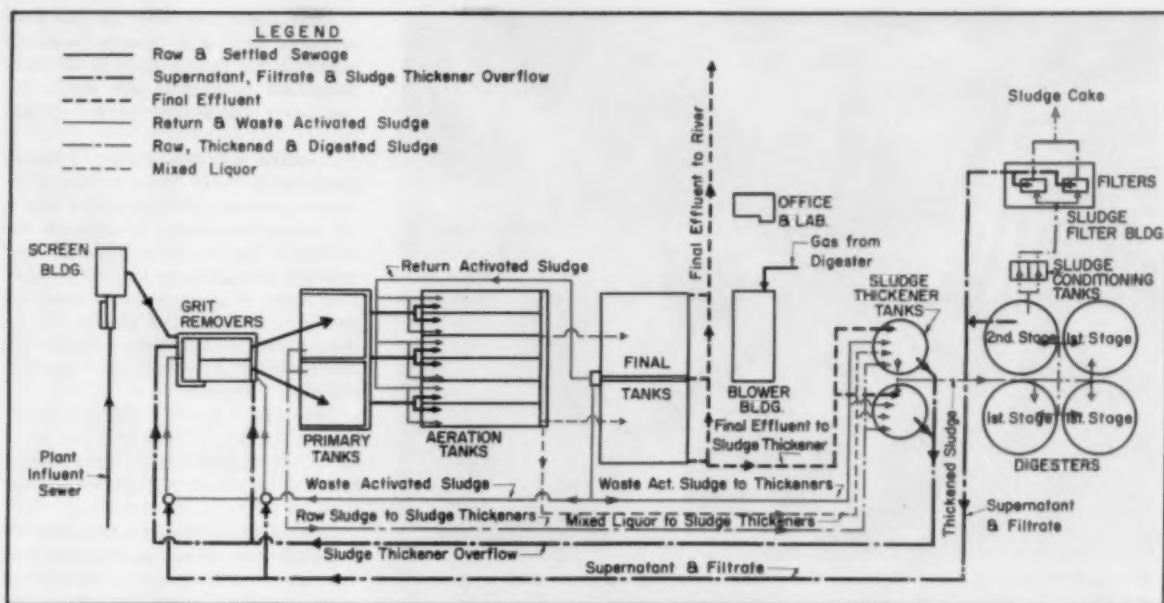
Some indication of the size of the Central District Filtration Plant project may be obtained by considering a few of the major items included in the contracts awarded to date as shown in Table 1.

The design of the Central District Filtration Plant is being done or supervised by the Filtration Design Division, Bureau of Engineering, Department of Public Works in consultation with the Bureau of Water, Department of Water and Sewers. The latter department will operate the plant.

The construction of the plant is being financed entirely by monies received from the operation of the water works system. Water works certificates issued for its construction are retired by water revenue. No tax money is used.

● CONSTRUCTION view showing cap around Shaft C-1 in foreground; and in background some of the 53,000 supporting piles and the cellular cofferdam construction.





● FLOW DIAGRAM of the plant. Not shown are bypasses and the extra aeration tank inlets which provide step aeration.

Sewage Treatment Plant Designed for INDUSTRIAL EXPANSION

FLOYD G. BROWNE

Consulting Engineer,
Marion, Ohio

SUNDAY, October 16, 1960, turned out to be a perfect fall day in Mansfield, Ohio, for the scheduled open house at the City's new \$4,000,000 sewage treatment plant. No doubt the weather helped to account for the unexpectedly large crowd of over 750 visitors who took advantage of the guided tours through the plant during the afternoon; but regardless of how desirable the day, people wouldn't have come to visit the plant if they hadn't wanted to see it and hadn't been informed the open house was to be held. Such a gratifying turnout therefore constituted a vivid demonstration of the results of a continuous program of good public relations on the part of the city administration along with excellent cooperation on publicity by the local news media, industries and various civic organizations. The citizens and tax payers who make a project such as this one possible by their support

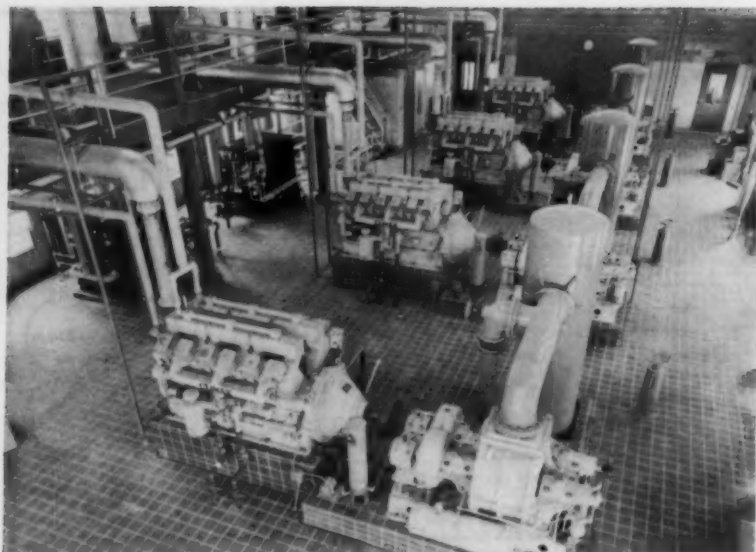
of administration proposals, policies and referendums deserve the opportunity afforded by an "open house" to examine the completed work. In Mansfield they overwhelmingly indicated, by their attendance, a sincere and intelligent interest in the accomplishments of their City government.

On the preceding Thursday 150 invited guests, including municipal, county, state and public health officials; representatives of the consulting engineers; the general contractor, sub-contractors and manufacturers were present for the dedication ceremonies. Altogether the new plant has thus played host to over 900 visitors. Each of these visitors received a copy of an eight-page brochure illustrated in full color with views showing of various parts of the plant, a flow diagram, an aerial photo and a map of the sewer system. The brochure also contained short descriptions of the city and the sewerage improvement program, an explanation of plant operation, and credits for those who played major roles in bringing the project to fruition. Since many who

did not visit the plant will have occasion to see the brochures, they are considered to have tremendous publicity value. An indication of their appeal is that though the original order placed was for 2,000 copies, the general contractor, several manufacturers, and even the printer decided to order additional copies for inclusion in their own advertising programs, so the final printing included over 3,000 copies.

Mansfield, the "City of Flowers" an industrial city in the center of the steel industry has experienced steady, substantial growth from 3,500 in 1857 when it became a city to its present population exceeding 51,000. With growth came problems, and one serious problem was outmoded and increasingly overloaded sewage treatment facilities. To investigate this problem and make a report with recommendations for necessary sewerage improvements, the city in 1953 retained the consulting engineering firm of Floyd G. Browne and Associates of Marion, Ohio.

Upon completion of their studies the consultants recommended a new



● **BLOWER building interior view.** There are four blowers, each with a capacity of 5,250 CFM. These are driven by four 225 HP engines using digester or natural gas.

sewage treatment plant of the activated sludge type designed for an estimated 1986 equivalent population of 110,000 including industrial waste flows and with adequate provisions for future expansion. In addition an extensively reinforced sanitary sewer system adequate to serve a connected population of 140,000 was recommended. The total program cost of \$8,500,000 was financed by the sale of \$2,300,000 worth of general obligation bonds and by the issuance of \$6,200,000 in sewer revenue bonds.

Plant Description

Dedication of the 15-MGD plant marked the completion of all the work recommended in the proposed program and the inception of use of the expanded, modernized new system. Following are descriptions of the various components of the sewage treatment plant, presented in the order of sewage flow through the plant.

Screen Building. The screen building is adjacent to the bypass chamber where storm flows in excess of the maximum plant capacity of 25 MGD flow over a weir, then through an outfall sewer to Rocky Fork Creek. Sewage flows into channels beneath the floor of the screen building through a 72-inch square motor operated sluice gate which permits throttling the influent flow to the plant as needed. Within the building the raw sewage flows through either of two mechanically cleaned bar screens which continuously rake coarse material from the sewage. Screenings are

ground in triturators and returned to the raw sewage flow downstream of the screens. An emergency hand raked bar screen is provided should it become necessary to bypass the mechanical screens.

Unusual wastes from industries are an ever-present possibility in this area, and one of the best means of early detection of industrial wastes discharges is to maintain a constant check on the pH of the incoming raw sewage at the plant. This is done by means of a pH meter which transmits its signal to indicators in the superintendent's office and the control room in the blower building. Correction of pH can be attained by adding chemicals to the raw sewage flow, and for this purpose chemical feeders are provided in the screen building for feeding lime and alum or Ferri-floc.

Preaeration, Grit and Grease Removal Tanks. Screened sewage next flows to the grit tank which has a total length of 49 ft., is 20 ft. in width and has a 15-foot liquid depth. Air supplied to this tank controls the velocity of the sewage, permitting inorganic particles to settle into a hopper. From the hopper the grit is removed by a bucket elevator, washed, and discharged by screw conveyor to a portable container.

Following grit removal the sewage flows through two preaeration and grease removal tanks, each 57 ft. long by 24 ft. wide by 15 ft. liquid depth. In these the sewage receives preaeration and the grease separates and rises to the surface of the tanks, where it is removed by automatic skimmers.

Total detention time in the preaeration, grit and grease removal tanks at the design flow is 45 minutes, and provisions are made for bypassing individual tanks of the battery.

Primary Settling Tanks. Preaerated sewage next flows to two 80-ft. square primary settling tanks, where 1.5 hours detention is allowed for settling. The raw sludge is discharged to a sludge well. The surface scum is automatically removed and mixed with the sludge, while the settled sewage passes to the six aeration tanks through aerated effluent channels.

Aeration Tank. Six parallel aeration tanks 222 ft. long by 25 ft. wide by 15 ft. liquid depth, provide six hours detention of the settled sewage flow.

One of the tanks is provided with a double set of air headers so that it may be used as a reaeration tank, in which event the remaining five aeration tanks provide five hours detention time for the design flow of 15 MGD.

The plant may be operated either as a conventional activated sludge plant with 100 percent of the settled sewage entering the head end of the aeration tanks, or utilizing the Gould process of step aeration, with up to 50 percent of the settled sewage entering the mid-point of the aeration tanks, and the remainder entering the head end. Rate of flow controllers set by the operator in the control room determine what proportion of the settled sewage will enter the head ends and the mid-points of the aeration tanks. Under either conventional or Gould process of operation the reaeration tank may be utilized, and in either case all return activated sludge (up to 50 percent of the settled sewage flow) is introduced at the head end of the aeration tanks.

Four distinct patterns of operation may be employed then, including conventional activated sludge without reaeration, the Gould process without reaeration, and either of these two with reaeration. Operating results indicating efficiencies and economies will determine the process finally used, and the flexibility available will permit varying the process as desired to accommodate changing flows, seasons or effluent quality requirements. Conventional operation without reaeration is being employed at present but as time goes on and plant flow increases it is expected that both the Gould process and reaeration will be used to advantage.

Final Settling Tanks. The two

final settling tanks are 100 ft. square by 11 ft. liquid depth; 2½ hours detention is obtained at average design flow. The activated sludge is removed by rotating suction type collector mechanisms. A portion of this activated sludge is returned to the aeration tanks by a battery of air lifts to form the mixed liquor. The excess activated sludge can be sent to the sludge thickeners or to the pre-aeration, grit and grease removal tanks.

Final effluent flows to the plant outfall sewer which discharges into Rocky Fork Creek. A portion of this effluent is pumped to the foam control sprays in the aeration tanks, and the final effluent can also be pumped to the sludge thickeners for mixing with raw sludge.

Sludge Thickeners. Two 45 ft. dia. by 10 ft. liquid depth Dorco sludge thickener tanks receive raw sludge from the primary settling tanks, excess waste activated sludge from the final settling tanks, mixed liquor from the aeration tanks and final effluent from the final settling tanks. It is anticipated that the raw sludge from the primary tanks at 2 to 3 percent solids will be concentrated to 6 to 8 percent solids in the four hours detention time provided in the thickeners prior to being pumped to the digesters. Thus less liquid will be added to the digesters, and less heat will be required, more digester capacity will be available, and gas production will be unaffected since total solids will remain unchanged. Overflow from the thickeners is returned to the pre-aeration, grit and grease removal tanks.

Digesters. The plant is provided with four digesters, three primary and one secondary; all are 80 ft. in diameter. Two of the fixed-cover primary digesters each have a side-water depth of 26 ft. while the third fixed-cover primary digester and the secondary digester each have side-water depths of 24 ft. The secondary digester is provided with a floating gas holder type steel cover which provides storage for 31,000 cubic feet of digester gas at 8 ins. of water pressure. Total capacity of the four digesters is 251,200 cubic feet. Circulation provided by gas lifters in the primary digesters provides a turnover rate of 45 minutes for the contents of each tank. Separate sludge heat exchangers are provided for each digester to maintain the sludge temperature at 95°F.

Supernatant from the digesters is returned to the raw sewage flow at the pre-aeration, grit and grease removal tanks, while digested sludge

flows to either of sludge holding tanks prior to filtering. These tanks are 20 ft. square by 15 ft. deep.

Blower Building. The blower building at the Mansfield plant is the center of operations, since it contains the control room with meters indicating the conditions of flow throughout the plant. Many of the flow conditions can be adjusted to suit operating requirements from this point. For example, the flow through the settled sewage rate of flow controllers, the raw sludge lines, the air lines to the pre-aeration tanks, aeration tanks, final tank air lifts, and the re-aeration air lifts, the

settled sewage bypass, and the final effluent conduit all are indicated on meters in the control room.

The blower building also contains the blowers supplying compressed air used in pre-aeration, grit and grease removal, aeration and re-aeration tanks; and for the air lifts used to pump return activated sludge from the final settling tanks to the aeration tanks. These blowers are driven by gas engines utilizing as fuel the digester gas produced at the plant with natural gas as an auxiliary fuel.

Other equipment in this building includes vapor-phase type gas en-



● CONTROL room, from which operation of the entire plant can be supervised, is located in the Blower building. Meters indicate flow conditions throughout the plant.



● WELL-EQUIPPED plant laboratory is located in the Administration building. It provides facilities for making all necessary tests for controlling plant operation.

gine cooling and heat recovery equipment, boilers for the plant heating system, wells, filters and softeners for the plant water supply, pumps, compressors and controls. In addition to the control room, blower room and basement, the building has a store room, workshop, sample room, locker room, washrooms and an employee's room.

Sludge Filter Building. The sludge filter building provides storage for ferric chloride and lime for use in sludge conditioning, chemical handling and feed equipment, and two coil-spring type vacuum filters, each having a surface area of 350 sq. ft. Conditioned sludge is applied to the filters and dewatered on them to a sludge cake having a moisture content of about 75 percent. The sludge cake is discharged from the vacuum filter drums onto a conveyor belt, and then discharges to a portable container for disposal.

The filter building also contains a washroom, garage and space for storage of the portable containers used for collecting and transporting grit and sludge cake.

Administration Building. The plant superintendent's office and a large, well equipped laboratory are located in a separate administration building. In the superintendent's office are duplicate indicating meters for the primary measurements shown in the control room, so that the superintendent may keep informed on plant operations without having to be in the blower building. The administration, blowers, sludge filter and screen buildings constitute a basic core around which the plant can be expanded for a minimum investment when the need arises, as no enlargement of these buildings would be required to double the present plant capacity.

Many industries cooperated wholeheartedly in helping the City of Mansfield solve its waste treatment problems by taking positive steps to decrease the pollutional loads which they were contributing to the city sewers and plant.

Notable among the industries which reduced the quantity or strength of their wastes by improved processing methods, better house-keeping and employee training or the construction of pretreatment facilities were Westinghouse Electric Corporation, Tappan Company, The Mansfield Plating Company, Dominion Electric Corporation, Kearns Packing Company, E. R. Boliantz Company and the Ohio State Reformatory in Mansfield.

Improved highways are known to be generators of traffic, in that more

cars will use them than had previously been indicated by counts of traffic volume to be anticipated, simply because drivers will go out of their way and pay a premium to utilize better roads. In similar fashion improved municipal facilities including sewage treatment plants can be generators of growth by making cities more attractive to industries. Mansfield's new sewage treatment plant is expected to be adequate in size for the needs of the area until 1980. By that time expansion may be necessary due to population and industrial growth which could be generated in part by the availability of adequate sanitary facilities. If public officials, as capable and far-sighted as the current Mansfield incumbents, are in office

when expansion becomes desirable, the City of Mansfield will be assured of prompt and proper action on additions to the plant and sewer system.

Acknowledgments

Most closely associated with the final phases of the project for the city were Mayor Robert S. Lemley, Service-Safety Director Jesse J. Schwab, City Engineer George W. Cunitz, and Plant Superintendent Lawrence E. Rigby. Carl D. Walker of Floyd G. Browne and Associates was Resident Engineer during construction, and George Eckstein was Construction Superintendent for the general contractor, Friebe and Hartman, Incorporated, Shelby, Ohio.

Suppliers of Major Equipment Items

American Cast Iron Pipe Co.	Cast iron pipe and fittings.
American Well Works	Pumps for raw sewage, waste activated sludge, mixed liquor foam control, tank drainage, filtrate, supernatant return and sanitary sump.
Armco Drainage & Metal Products Co.	Sluice gates, slide gates and steel pipe.
B-I-F Industries, Inc.	Flow controllers, instrumentation and chemical feeders.
Climax Engine Mfg. Co., Div. of Waukesha Motor Co.	Gas engines.
Chain Belt Company	Mechanical bar screens, automatic scum removal equipment.
DeZurik Corporation	Plug valves.
Dorr-Oliver Inc.	Primary tank collectors, sludge thickener mechanisms, sludge heat exchangers.
Dracco Div., Fuller Co.	Pneumatic conveyor.
Engineering Controls, Inc.	Engine cooling and heat recovery equipment.
Fairbanks, Morse and Company	Storm drainage pumps.
Ingersoll-Kalamazoo Div., Borg Warner Corp.	Portable containers for grit and sludge cake.
Komline-Sanderson Engineering Corp.	Sludge filtering equipment.
M & H Valve & Fittings Company	Gate and check valves.
Preload Co., Inc.	Pre-stressed concrete digesters.
Roots-Connersville Blower Div.	Air blowers and gas meters.
Walker Process Equipment, Inc.	Grit removal, pre-aeration and aeration equipment, air lifts, final tank collectors, digester circulation equipment and digester gas holder cover.
Western Machinery Co.	Pumps for raw sludge, thickened sludge, sludge circulation and digested sludge.



● **TAILGATE** spreader applies calcium chloride at the rate of about 1½ pounds per sq. yd. following shaping and compaction.



● **LEANING** wheel grader shapes the road in preparation for application of calcium chloride; 20 hours time were required.

STABILIZATION SAVES TOWNSHIP ROADS

LLOYD G. BYRD
Associate Editor

WITH ONE of the largest areas within its boundaries of any township in the State of New Jersey, Franklin Township has been exploring the advantages of stage construction to maintain and improve the 115 miles of township roads, of which 25 miles are gravel or dirt and 71 miles are oiled surface. On the unpaved, traffic-bound sections with undetermined base depths and strengths, light surface treatment with asphalt and stone chips has provided only short surface life. Failures are particularly severe in the spring of the year, when frost leaves the bases loose, saturated with moisture and insufficiently stable to support the treated surface. As failures and pot-holes or rutting occur, two unsatisfactory alternatives are open to maintenance personnel: One, to attempt to patch the localized failures with bituminous concrete patching mixes or skin patches of asphalt and chips; the other, to scarify and reshape the failed surface, thus losing the entire surface treatment and returning the surface to a traffic-bound status.

As an alternative to this repetitive and costly cycle of surface treatment and repair, an experimental program of stage construction was inaugurated last summer on ½ mile of the Weston Road. The

long-range objectives of this program include:

1) Holding the present status of the system through an economical program of calcium chloride stabilization of all unpaved roads.

2) Careful grading, ditching and addition of crushed stone and fines, where required to build up adequate base courses to carry the traffic loads required.

3) Use of the savings derived from the above program for scheduling, on an annual basis, a pavement surfacing program on those sections where bases have been developed through stabilization.

The potential benefits of such a program offer an economical means of maintaining all-weather surfaces on all township mileage while carrying on a steady addition to the miles of surfaced roadway and leading ultimately to a township system in which all roads are surfaced.

Franklin Township's program is carried out under the direction of William Sommers, Township Manager, and George Micklo, Superintendent of Public Works. Their 17-man crew is equipped for road maintenance with four 5-ton, two 2½-ton and three pickup trucks (GMC, FWD, International and Chevrolet); three Temple tailgate spreaders; two Galion motor graders; a Huber roller; one IHC backhoe; a Michigan loader; one Flink and two Tarco spreaders; and a McCormack tractor-cutter. The stabi-

lization work included the careful reshaping of the road crown as an "A" or inverted "V" to assure rapid run off of surface moisture. During grading operations, the blade was angled to draw material from the road berm onto the center of the roadway thus recovering base aggregate and fines which had been whipped off by traffic. After the surface was satisfactorily shaped, the 10-ton 3-wheel roller was used to compact and smooth the surface. The use of rubber-tired compactors or the action of traffic are satisfactory alternates to gain compaction of the surface. Compaction was followed by the application of calcium chloride, using the tailgate spreaders to obtain a nearly uniform coverage of 1½ lbs. per square yard. Ideally, this work is done in the spring or very early summer while the presence of atmospheric moisture permits the calcium chloride to go into solution quickly.

The timetable for the 1960 work was as follows: June 7, road shaping with a motor grader, 8 hours. June 8, initial chloride application, four men for four hours each; a 5-ton truck, a motor grader and the roller for four hours; and 75 bags of calcium chloride. Aug. 9, secondary application, three men, a 5-ton truck and the roller for 8 hours each, and 150 bags of calcium chloride. Hourly charges were made against the work as follows: All personnel \$2; motor grader \$20; 5-ton



● SCHOOL bus traveling on gravel road before stabilization stirs up an old-time dust cloud with the attendant hazard of lack of visibility and personal discomfort.



● AFTER treatment with calcium chloride, the Weston Road looked like this. The severe weather of the past winter did not result in need for any maintenance work.

truck \$10; roller \$15; calcium chloride \$2.11 per bag. The total cost amounted to \$1,110.75.

An inspection of Franklin Township's experimental mileage of chloride-stabilized surface was made early this spring after a winter of unusually severe frost damage to New Jersey roads. The surface was tight, sound and well graded. Supt. Micklo said that he had had no maintenance problems on the section and had not even been required to perform grading operations there this spring. In addition to its stability after a severe winter the section promises to reduce the dust problem during the dry summer months and the resultant loss of surface fines and aggregate. Stabilization and stage construction promise to be a significant part of

the township road program in this and future seasons.

Present plans call for calcium chloride treatment on two or three miles of dirt and/or gravel roads each year until all such mileage has received this treatment.

• • •

Operation of An Activated Sludge Plant

The activated sludge sewage treatment plant at Cranston, R. I., Walter C. Anderson, Supt., during the 1960 fiscal year provided an average aeration period of 5.69 hrs. and used 2.4 cf of air per gallon of settled sewage; return sludge was 35 percent, average suspended solids in the tank liquor 1,064 mg/L, sludge index 496 and DO at outlet 4.9 mg/L.

Roadside Sign Radio Control

The New Jersey Turnpike Authority has awarded Motorola Communications and Electronics, Inc., a contract for radio control of roadside warning signs. The 67 neon signs to be radio-controlled show motorists six basic messages. They are DRIVE SLOW, ACCIDENT, AHEAD, SNOW, ICE and FOG. Some locations also display reduced speed limit numbers. For radio control, the 67 signs are divided into 10 groups. Any combination of words at a single sign, at all or part of the signs in a group, or at all signs on the turnpike will be turned on and off by radio from a central location.

A control center in the Turnpike Administration Building in New Brunswick will serve as the system nerve center. It will include facilities to operate both the sign control system and the turnpike maintenance network. One wall of the center will include a 19-foot long map of the turnpike for displaying the status of each of the 67 illuminated signs at any given moment.

The dispatcher in charge of the center will be able to utilize any one or any group of five base repeater receiver-transmitters, spaced about 25 miles apart at turnpike police stations, to transmit coded control tones to roadside signs or to send voice messages to maintenance vehicles and offices.

Remote control of signs by radio is achieved within five seconds. Presently, the same job is handled by sending a trooper in a vehicle to the sign locations to control them manually. With the new system, the dispatcher at New Brunswick merely presses four buttons to display DRIVE SLOW ACCIDENT AHEAD at a sign near Swedesboro, about 70 miles away. His selection at the sign control console, one button for the sign and three for the words, is converted to distinctive radio signals and transmitted to the Swedesboro base repeater for rebroadcast.

A fully transistorized receiver-decoder unit at the sign picks up the signal and decodes it. The tones are converted to relay voltages to illuminate the four-word message on the sign. Other signs or the SNOW, ICE or FOG messages on the same sign are not affected because of the distinctive coded tones used. Series and groups of signs can be selected in the same fashion.

The maintenance segment of the system is scheduled for completion by early fall. The sign control system which is capable of being expanded 200 percent, will be in operation in early 1962.

COUNTY WATER SYSTEM FEATURES ADVANCED AUTOMATION

C. G. RUSSELL ARMSTRONG
Consulting Engineer,
Windsor, Ontario

AS A RESULT of the increasing shortage of water in Southern Ontario, and the pollution of its rivers and of the lower Great Lakes, the Ontario Legislature in 1955 directed the Ontario Water Resources and Supply Committee to investigate and report upon the situation. Following a report by the committee, the Legislature in 1956 established The Ontario Water Resources Commission.

One of the principal responsibilities of the commission is to help any municipality in Ontario to obtain an adequate supply of pure water and to dispose properly of its sewage and industrial wastes. The commission will make an agreement with the municipality to design, build, finance and operate such works. It is also possible for two or more municipalities to enter into an agreement with the commission for the construction of integrated water or sewage works.

Essex County's Union Water System, which serves the Towns of Leamington and Essex; the Townships of Gosfield North, Gosfield South, Mersea and Maidstone, as well as two major canning industries, was the first integrated water system undertaken by the commission.

Under the financing plan of the commission, the municipality does not have to issue or sell any debentures or bonds. The money is supplied by the commission, and the credit of the province is pledged for this. The debt is paid over a long period, 30 years in most instances, and the interest rate is the actual cost of money borrowed by the province, which rate is usually lower than it is possible for a municipality to obtain on its own.

The administration of the Union Water System is under the auspices and control of the Ontario Water Resources Commission which operates and maintains the plant and

trunk watermains. The individual municipalities are responsible for their own distribution systems. The commission employs a staff for the operation and maintenance of the water treatment plant and trunk distribution system, and the personnel are backed up by the head office technical and administrative staff of the commission located in Toronto, so that special services are available whenever needed.

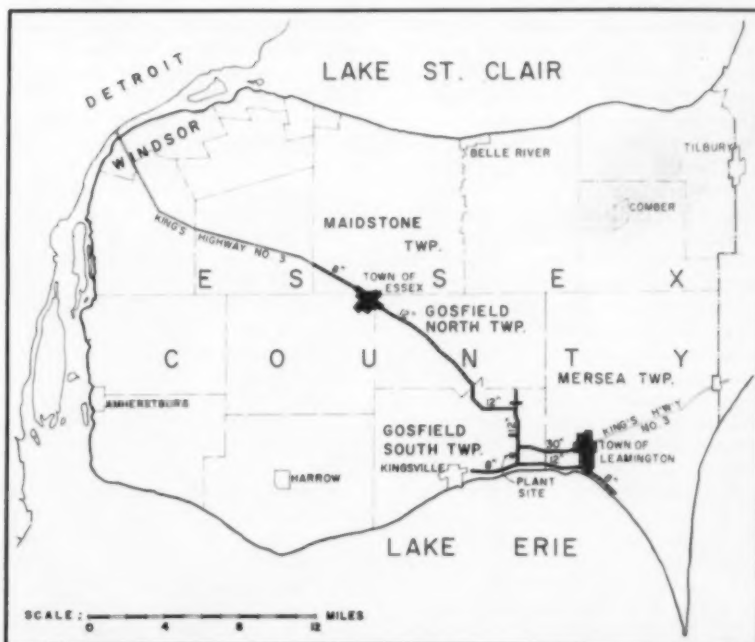
The demands of a greenhouse and truck farming community, the largest canning factory in Canada, and a considerable summer recreation and holiday population, in conjunction with two towns, and intervening townships and villages having a total population of approximately 12,000, was much in excess of the available water supply in the area prior to the establishment of the Union Water System.

The average consumption attributed to the population did not bear any reasonable relationship to the maximum demands of the canning

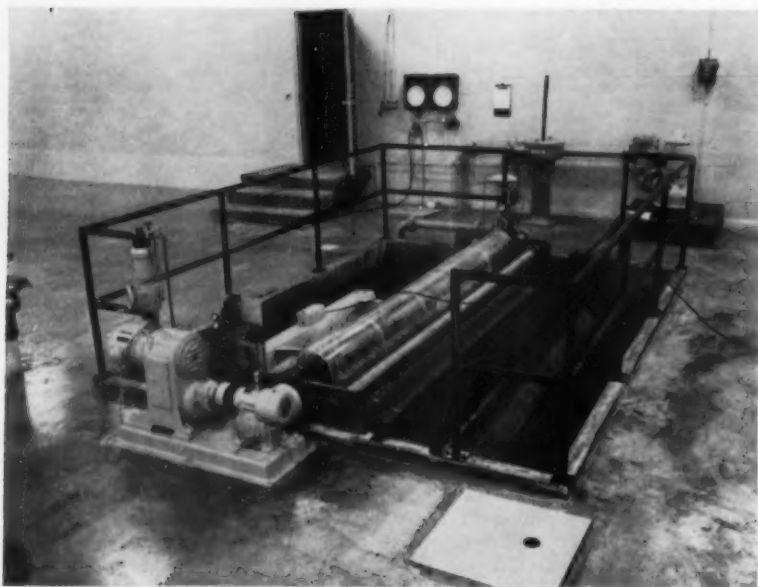
operation and of holiday crowds. This resulted in extreme conditions of demand with relation to the normal winter requirements of the community.

Consequently, it was necessary to design a filtration plant to provide for these maximum demands which extended over a period of only three to four months during the summer. The plant was designed to handle initially 8.0 million Imperial gallons per day (MIGD). The treatment processes comprise coarse screening, followed by low lift pumping and micro-straining; solids contact clarification preceded by chemical application and prechlorination; and the final processes of rapid sand filtration, storage and post-chlorination. Facilities and layout are arranged in such a manner that ultimate extension of the plant can be arranged symmetrically for a total of 32 MIGD.

The filtration plant represents the most modern accepted design practices and incorporates modern



● MAP SHOWS principal communities served by the Union Water System.



● MICROSTRAINER provides effective treatment for algae removal. This is a 10 ft. by 10 ft. unit with automatic controls to increase speed and wash water as necessary.

architectural features. The interior of the plant has been constructed of building materials lending themselves to ease of cleaning and maintenance. Piping has been arranged for ease of extending the capacity of the plant with a minimum of construction difficulty and without interruption of service.

Colors used in the plant interior were selected to give a bright clean appearance and all the piping has been color coded to enable operators to trace easily the piping facilities and process functions. A pipeline flow diagram on the master control panel in the main control room is in the pipe coding colors. This panel provides completely centralized instrumentation and control so that the plant can be operated as a fully automatic plant.

The trunk distribution mains consist of a 30-inch reinforced concrete line 4 miles long serving the Town of Leamington; a 12-in. cement-lined cast iron main 4 miles long to the Town of Leamington; and a 12-in. line of cement-lined cast iron and asbestos cement 14 miles long to the Town of Essex. Additional mains in the Townships of Gosfield North, Gosfield South, Maidstone and Mersea serve parts of the intervening countryside and these mains are expected to be extended as the demand in the adjoining area increases.

At a high point half way between Ruthven and Leamington a 333,000 Imperial gallon elevated water tank, 115 feet high, is connected to the 30-in. main with an automatically

operating altitude valve; and an automatic booster station is located at the Village of Cottam half way between Ruthven and Essex on the 12-in. main.

Intake and Low Lift Pumps

The raw water intake for the system is on Lake Erie. It consists of a crib connected by a corrugated metal pipe 54 ins. internal diameter, 1400 ft. long, with heavy bitumen linings inside and out. The pipe is laid approximately two feet underneath the floor of the lake. It connects to the inlet well of the low lift pumping station and is capable of passing up to 40 MIGD.

The low lift pumping station is equipped with an inlet chamber and hand-raked coarse screen, dividing into twin chambers one of which contains an automatic travelling water screen capable of removing solids greater than approximately half-inch size.

The four low lift pumps which raise the water to the filtration plant for treatment are of vertical turbine type, two of 2 MIGD capacity each and two of 4 MIGD capacity each.

One of the 4 MIGD units has a combination electric motor and right angle gear diesel engine drive which enables the engine to cut in automatically in the event of power failure. In addition there are facilities for telemetering the well level and pump operating conditions to the master control panel at the filtration plant where remote supervisory control functions can be carried out. An access road leads down

to the low lift area and the shore is protected by two breakwaters.

The Micro-Strainer

Water is discharged from the low-lift pumping station to the micro-strainer which is a 10-foot diameter by 10-foot long unit provided basically for the removal of algae. The complete or partial removal of algae is anticipated to be extremely favorable to the operation of the filters, particularly in warm weather. During the twelve months which the plant has been in operation this has been found to be the case, and under the very worst conditions which sometimes arise when onshore winds bring high algae and turbidity concentrations to the filtration plant, it is almost mandatory to have this unit in full operation. When the micro-strainer is not utilized under these conditions, the length of filter runs are reduced to one-third or one-fourth of that possible when micro-straining is used; the unit however, does not remove colloidal turbidity. The stainless steel woven wire fabric has a maximum opening of 35 microns.

The operation of the unit in a manner consistent with its design requires that the speed of the drum and the pressure of the wash water applied to the surface of the fabric be increased as the differential head across the fabric increases. Accordingly, a system is provided which automatically increases the wash water pressure applied to the fabric proportionally in relation to a range of 0 to 5 inches differential head across the fabric. A continuously operating wash water pump provides chlorine-free micro-strained wash water to jet wash the stainless steel fabric at the controlled pressure necessary to maintain the fabric clean.

At many installations on the Great Lakes a peculiar condition of extremely high algae count occurs when the ice cover is forming and when it is breaking up. It has been discovered that this tends to overload the micro-strainer despite high pressure wash water application and increased speed. To combat this condition in part, an ultraviolet light of high power has proved experimentally to be reasonably successful in eliminating the overload conditions which occur during these times of the year. Although this unit is not a complete answer to the condition and while sometimes it becomes necessary to bypass a portion of the incoming water, in general, considerable improvement in oper-

ation has been possible due to its installation.

The micro-strainer control functions are shown and reported on two recorders, one of which is a two-pen unit which records continuously the differential head across the screen and the quantity of wash water used in carrying out the washing function; while the second recorder shows the variation in wash water pressure.

Chemical Feed

Two dry chemical feeders with bucket elevator conveyors and two liquid alum proportioning pumps, each capable of feeding up to the ultimate plant capacity requirements, are automatically controlled from signals received from the master control panel. The piping from these feeders to the clarifier where the chemicals are added is Uscolite for the dry chemical slurry, and lead pipe for the liquid alum which is stored in lead lined liquid alum tanks. These two tanks are each 4,500 Imperial gallons capacity and it is hoped will serve the ultimate needs of the plant.

The liquid alum proportioning pumps are unusual in that they are not operated by time impulse cycle, but by variable stroke length. It has been found that variable stroke length proportioning is not as suitable as time impulse duration control which would normally have been provided at this stage of construction, but it is believed that it will eventually prove more suitable during the higher rates of flow eventually prevailing during the high demand season.

Clarification

A 94-ft. diameter by 19-ft. side water depth Graver Reactivator clarification unit of the solids contact type has been installed. It has a capacity of 8 MIGD when producing an effluent having not more than five mg/L of suspended solids and turbidity. It is of steel in a concrete tank and is provided with a variable speed drive unit, scraping equipment, and automatic desludging facilities, which ensure that with nominal adjustment it can carry out efficient continuous clarification. The retention at the design flow of 8 MIGD is approximately 2.4 hours and the overflow rate is 1.08 U. S. gallons per minute per square foot.

The Filters

There are four 18 by 36-ft. double type filters of two MIGD capacity each, all totally enclosed in aluminum curtain wall and glass en-

closures. The double type enables the use of a more economic size of wash water piping. The filters are provided with Miller pre-cast filter underdrains. The gravel consists of five layers, each three inches thick; and the sand is 0.55 mm, 27 inches thick. The filters are provided with Palmer agitator surface jet wash and normal backwash operating fully automatically from the Master Control Panel.

The inlets and outlets to the filter are controlled by sluice gates and butterfly valves all of which are automatically operated.

The operation of the filters is based on a design rate of filtering of 2.5 U. S. gallons per minute per square foot and this establishes a plant capacity of 8 MIGD. The filters are automatically controlled to operate at a constant rate of filtration in answer to the setting on the rate of flow control equipment of the master control panel. The variations in daily demand are adjusted by bringing on an additional filter for such period of time as necessary according to a level signalling system from the clear water reservoir. The filters are provided with wash water outlet troughs capable of handling the maximum rate of backwash, with a rise of 28 inches per minute. In conjunction with the Palmer agitator sweeps, the filters are found to be very effectively cleaned.

Automatic signalling and recording of loss of head initiates fully automatic backwashing at a maximum loss of head signal, and on completion of backwash return to service. The local control consoles located in the filter operating gallery enable the operator of the plant

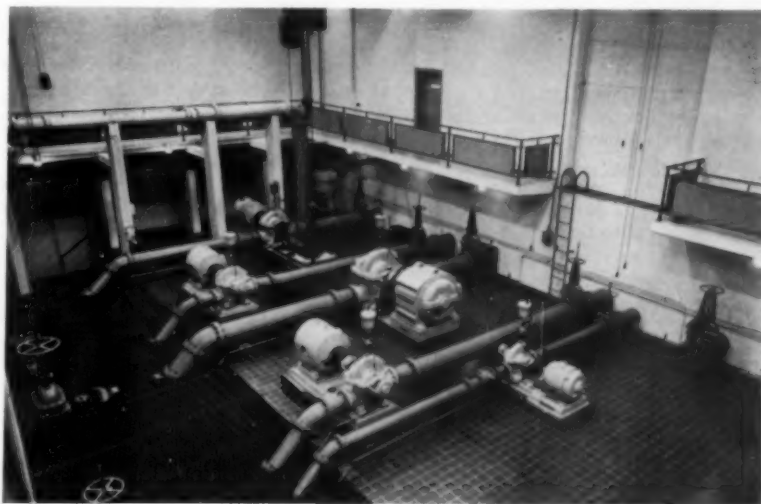
to carry out manual backwashing if he considers this advisable or necessary, the filter being set up for manual backwashing at the Master Control Panel before the operator proceeds to the local console to carry out the actual backwashing sequence.

One of the novel features of these consoles is the use of pneumatic positioners to set the control valves on the main and jet wash water lines. It is impossible for the operator to open a valve faster than the restriction in the air line allows. Thus the possibility of manual error in bringing wash water in at too fast a rate, which might cause disturbance of the gravel and sand bed, is eliminated.

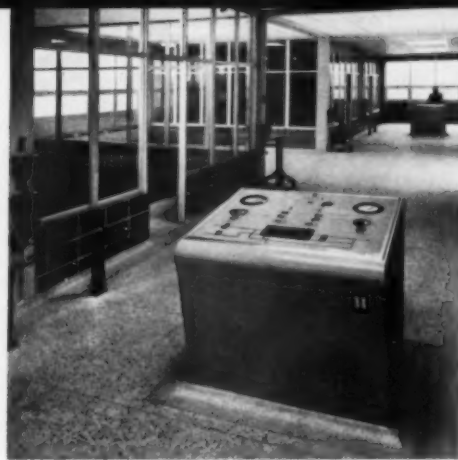
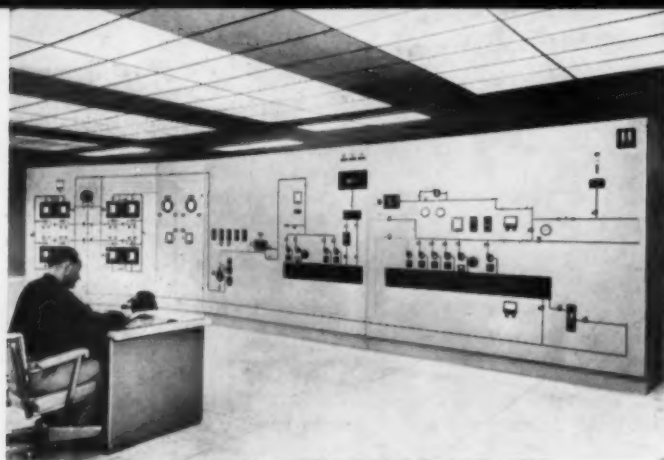
Chlorination

The chlorine feed room facilities comprise a prechlorinator, a post-chlorinator and a standby chlorinator, each machine capable of feeding up to 2000 pounds per twenty-four hours. The standby machine can be operated on either the pre-chlorine duty or postchlorine duty and these units are piped to the points of application of the chlorine with Uscolite pipe.

A chlorine residual recorder indicates the residual as it leaves the filters in the case of prechlorination; and as it enters the distribution system in the case of postchlorination. This unit will ensure that any high or low amounts of chlorine, which may result in the water becoming inadequately chlorinated or over-chlorinated, will automatically signal the operator to adjust the appropriate dosage to ensure optimum conditions at all times.



● MAIN PUMP room contains five pumps, one to ten mgd capacity; and a 4000-gpm wash water pump. One 4 mgd pump has dual drive with a diesel engine standby unit.



● MASTER control panel, left, enables operator to see precise operational condition of plant. Filter gallery at right.

There are facilities for storing up to six one-ton chlorine cylinders, and a weigh scale graduated to 5000 pounds is provided on which two one-ton chlorine cylinders can be mounted.

It has been found adequate and acceptable to both the community and the public health standards of the province to feed chlorine as pre-chlorination with a residual of approximately 0.1 mg/L in the water applied to the filters, and to maintain a residual in the discharge to the distribution system of 0.35 mg/L which has been adequate to leave a trace at the furthestmost end of the system. Under normal operating conditions it is unnecessary for the plant superintendent to alter his dosage above 0.5 mg/L to maintain such a trace under existing conditions in the system.

Pumps and Valves

The main pump room is provided with five distribution system pumps in capacities ranging from 1.0 MIGD capacity up to 10 MIGD capacity, and a 4500-gpm wash water pump. The 4.0 MIGD unit is provided with a dual drive, electric motor and diesel engine. All the pumps are automatically operated and there is space for future pumps to enable the plant to be extended to its ultimate capacity.

The pump room, which is approximately 72 feet long by 36 feet wide, is provided with an overhead travelling crane for service, repair and maintenance work.

The low lift pumping station has a separate sub-station supply with an initial rating of 750 KVA with transformers, switchgear and motor control center, from which all units in the low lift station are supplied with power.

The high lift pumping station is provided with a sub-station with an initial rating of 1500 KVA with transformers, switchgear and motor control center for all the equipment

in the filtration plant. In addition, space is provided at both locations for motor control equipment for all future extensions.

Cabling from the sub-stations to the incoming switchgear is in Neoprene jacketed aluminum sheathed cable as a protection against corrosion. Inside the plant copper mineral insulated cables are used throughout for motor connections. The lighting distribution system is standard conduit and wire.

The valve room contains the piping connecting the micro-strainer to the clarifying units, and the return piping from clarification to filtration. It is so designed that the space available will permit the ultimate installation of piping with full flexibility in by-passing or cross-feeding of water between clarification and micro-straining stages and filtering stages. Thus service on any unit can be carried out without shutting down any other portion of the plant.

Automation

The modern functional and efficient operation of this water treatment system is achieved by the incorporation of automatic control equipment arranged to operate from a centralized Master Control Panel which enables the operator to place the plant in fully automatic operation.

In addition the plant is provided with proportional control facilities for chemicals, chlorine, and compensations for distribution system flow variations.

The functioning of the distribution system and the operation of the Leamington elevated tank, the storage reservoir at the Town of Essex, and the Cottam booster station, are telegraphed to the plant by means of telemetering facilities provided at these remote locations, so that the operator of the plant is aware at all times of the conditions existing on the system.

The automatic operation of the filters includes automatic backwashing when any filter becomes dirty, followed by placing it back into service after it has been cleaned.

There are facilities which enable the operator to convert the plant to a fully manual station, either operating under push button control or, in the event of disaster, under hand wheel facilities as plants were operated fifty years ago.

It is believed that the automatic control functions provided in this filter plant are at least as advanced as any other filter plant in North America at this time.

The Control Systems

The controls provided on this plant are substantially a combination of pneumatic and electrical control systems. The pneumatic systems interpret, indicate and record the flow and levels in the various portions of the plant; they utilize and transmit these functions to the several units which make use of them in proportioning the operation of the plant in relation to the flow passing through. In addition to this basic pneumatic system is the electric sequencing which carries out the necessary switching functions on valves, pumps, and other items.

The whole control system is based on the centralized Master Control Panel, located in the main control room, on which all the indications and records necessary for the operation of the plant are indicated. This is laid out in a simple flow diagram using miniature instruments enabling the operator of the plant to see the precise operational condition of the plant at all times.

In brief, the diagram represents the flow of water from the lake through a low lift pumping well and thence by the low lift pumps to the micro-strainer and clarifier. The low lift pumping station operation can be carried out automatically or manually from this Master

Control Panel and can be overridden with suitable lockouts at the low lift pumping station in case of service or maintenance at that location. The functioning of chemical feed and chlorination equipment is indicated on the panel. This includes residual indication for pre and post-chlorination which are alternated by suitable switching devices located on the chlorine residual recorder.

The function of surplus sludge discharge from the clarifier is controlled automatically on the basis of time settings on the face of the control panel. Under normal operating conditions the filtration process, including backwashing of the filters, is carried out automatically, but can be overridden by moving the master selector wheel through an "off" position to a "hand" position, so that backwashing of filters can be performed at the local console. The operation of the filters is on the basis of a level control system in the reservoir so that steps of filtration increase as the level in the reservoir reduces, and then remain at their maximum rate until the

reservoir has been completely refilled. The filter operation then reverts back to a one filter operating step of filtration. The high lift pump well is indicated by a large longitudinal block similar to the low lift pump well and all the high lift pump functions are indicated on this panel.

The operating conditions at the Cottam Booster Station are telemetered from that location to the panel and indicated on the panel as are the level conditions in the reservoir at Essex and in the elevated tank near Leamington. This telemetering system is an indicating system without supervisory control, but the function of valve operation at the reservoir, and pump and valve operation at the Cottam Booster station, is performed automatically at those locations by local control loops, installed at those locations.

In the event of trouble, safety shut-down conditions are provided at the local location and immediately signalled to the plant so that an operator may then proceed to rectify the failed condition, but while

he is proceeding to those locations, protective devices ensure that no damage occurs to the equipment or distribution system.

The complete installation of all this equipment was included in the contract with the manufacturer, Honeywell Controls, Ltd., who was entirely responsible for the correct supply, installation and functioning of the system. This manner of placing responsibility on one contractor has resulted in a most successful operating plant. The specifications for the equipment were basically functional but on later jobs of a similar nature we have found it more suitable to enter into somewhat greater detail to ensure the correct application of control equipment to the processes used.

By the use of automation in this plant it has been possible to provide water treatment and distribution for unusual demand conditions without the need for a considerable work force to operate it. The system, despite being adaptable to unattended operation, is attended by a one man shift at all times. This man is in attendance at the filtration plant where he is able either by visual checking on the Master Control Panel or from audible warnings to check into any failure condition. If the failure is such that replacement of the unit failed does not occur automatically but requires immediate attention the operator can then ask an on-call man to come and assist him.

In addition to the operational staff, the superintendent has available two janitorial assistants, and one maintenance electrician who is responsible for the electrical and automation equipment. The total staff for the operation at this time is nine men. It is not anticipated that more men will be necessary at the filtration plant, unless an additional maintenance man should be required. When the extensions to the plant are carried out, they will involve merely repetition of certain phases of equipment. Since such equipment will be incorporated in the master control system under full automatic control, expansion of the work force is expected to be purely nominal.

After operating for approximately one year it has been found that apart from the most unusual circumstances of water quality the automatic control functions of the plant operate extremely well, and in fact perform the process functions of the plant in a more efficient manner than is possible by manual control.

Equipment and Manufacturers

Intake Pipe and Sluice Gates	Armco Drainage & Metal Products of Canada Ltd.
Instrumentation	Honeywell Controls Ltd.
Vertical Turbine Pumps	Johnston Pump Company
Vertical Hollow Shaft Motors	U.S. Electrical Motors Inc.
Sub-Stations	Canadian Line Materials Ltd. and Canadian Westinghouse Ltd.
Motor Control Centers	Canadian Controllers Ltd.
Diesel Engines	Rolls Royce (Canada) Ltd.
Concrete Pipe	Pressure Pipe Ltd.
Flow Measuring Elements	George Kent (Canada) Ltd. and Sparling Meter Company
Cast Iron Pipe	Canada Iron Foundries Ltd.
Butterfly Valves	S. Morgan Smith (Canada) Ltd.
Horizontal Centrifugal Pumps	C. H. Wheeler Mfg. Co.
Gate Valves	Jenkins Brothers Ltd.
Microstrainer	Glenfield & Kennedy Ltd.
Telemetering	Bristol Company of Canada Ltd.
Chemical and Chlorine Feed Equipment	Wallace & Tiernan Ltd.
Plumbing Installation	Windsor Plumbing & Heating Ltd.
Electrical Lighting Installation	Wilson & Somerville Ltd.
Clarifier	Graver Water Conditioning Co.



● ON READER-printer unit made by 3M, 18 by 24-inch projections are made; operation of a push button will make and deliver an 18 by 24-inch print in half a minute.

PHOTOGRAPHIC RECORDS Aid Highway Condition Studies



● WITH TIME and motion study projector, positive copies of film records can be studied by a group. Data board at bottom of frame shows where photo was taken.

COLLECTION of complete, detailed information about highway surfaces and sufficiency rating data can be a time consuming and costly undertaking. One company which believes it can expedite these data-gathering problems is Aero Service Corporation. This firm has developed three highway surveillance tools designed for research, inventory and maintenance purposes.

One of these, called Sur/Fax, provides detailed photo records of pavement surfaces; Photo/File is another film recording device that shows highways and their surroundings from the driver's point of view; in the final stages of development is a group of electronic instruments for measuring geometry of roads, including curves, grades, superelevations and roughness.

Sur/Fax System

Basic components of the Sur/Fax system include a specially-outfitted truck; a precise 35 mm continuous strip camera; a continuous strip film projector; and a reader-printer unit for making enlargements of areas of particular interest. These provide an objective, consistently detailed, permanent film record of the pavement.

The Sur/Fax road unit and camera—mounted on top of a 14-foot telescoping boom—records highway surfaces as wide as 36 feet in a single pass. Pavement conditions register on the 35 mm film base at a scale of about 36 feet to the inch.

Since these surveys are conducted only after dark, usually between one and five a.m., the truck is equipped with banks of shielded floodlights. This controlled lighting gives maximum modeling to roadway conditions and objects and the pre-dawn operations reduce traffic congestion problems.

Transverse and longitudinal cracks, pumping, raveling, popouts, patches, and scaling are photo-recorded by the camera as the truck moves at 20 to 40 mph. With the constant-level lighting arrangement, these conditions take on a three-dimensional aspect, making them easy to read and identify. After the strip film has been processed, photo enlargements can be annotated to show the exact location and severity of specific defects.

Several methods can be used to mark or calibrate the film during a survey: Symbols on the pavement, or number-markers on the film indicating distances from starting points, coordinates or other landmarks.

In addition to the negatives and enlarged prints, positive film strips for all or part of the survey area can be produced and can be shown on a screen as large as 10 by 10 feet. These are suited for conference studies, preliminary investigations and general planning and are also a valuable public relations tool. The viewer can scan the film strip at any desired speed and a particular scene can be examined as long as necessary, without film damage or fire hazard.

In cases where positive enlargements of highway sections are needed immediately, 18 by 24-inch blow-ups can be made from a newly developed reader-printer unit. As pavement sections are brought into sight on the viewing screen, a push button makes a contact print of the area within 30 seconds. These prints can be used for further study, for detailed analysis, or as an actual work sheet by highway maintenance crews. The data also can be transferred to punch cards for rapid processing in IBM or other electronic computers.

Since its introduction, Aero has performed two comparison-type surveys at the AASHO test road in Illinois. Surface condition data for April, 1960, are being compared with results of an October examination.

Photo/File

Photo/File, like Sur/Fax, uses truck-mounted cameras. It is designed to provide a complete, recorded view of all physical conditions along the highway from the viewpoint of the motor vehicle operator; and also to record the type and condition of traffic signals, signs, curbing, guard rails, center and side-of-the-road drainage, access roads and driveways, plus safe pass-



● **PRECISE 35mm strip camera and high powered lights are used in surveys. Night work permits control of light intensity.**

ing and stopping sight distances. It is particularly useful for sufficiency rating survey work.

Two synchronized, specially-modified 16 mm cameras, equipped with electronic exposure controls, are used for Photo/File surveys. These cameras, coupled with sequential timing and mileage indexing equipment, are mounted in the front and rear of the survey vehicle, furnishing complete photographic coverage.

This road unit records the forward-looking and backward-looking images at 1/100th mile intervals, or about every 53 feet. Exposure intervals can be varied, depending upon the amount of detail and information needed. Operations are usually conducted, using black and white film, during daylight hours. However, for special studies, such as highway investigations, sign or traffic signal visibility tests, surveys can be performed during early morning hours, at dusk or during rain; or color photography can be used.

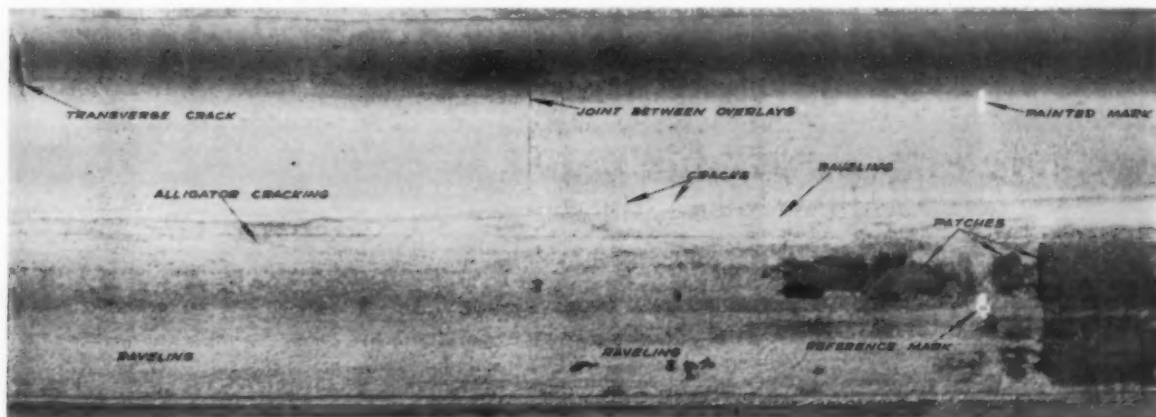
For conference room study and planning, positive copies of the film records can be projected on a screen approximately 4 by 5 ft. The projector is equipped with a rapid-scan device; a manually operated, slow-speed mechanism; and a counter which can be set to correspond to the odometer reading on the film's data-board. These devices aid in rapid location of any area on the film.

Driving the highway at speeds in excess of 100 mph can be simulated with the projector, as well as average or even slower-than-normal-speed rates. Intersections, sharp curves, center lines or any other areas requiring detailed analysis can be held on the screen for as long as necessary.

Photo/File records can be stored in a small amount of space. Some 10,000 miles of two-lane highway, inventoried in both directions, can be recorded on 500 rolls of film and can be filed in a cabinet 24 by 24 by 30 ins. Duplicate prints can be made available for use in regional offices.

Electronic Aids

Now in final stages of development by Aero is a series of geometric measuring devices for highway surveillance work. These electronic instruments will measure and record the shape of the road, plus the number and degree of irregularities that are a hazard to drivers. These new systems have been tested over a variety of highway conditions. Some of the inconsistencies registered include road grade, roughness, superelevation, slopes, crowns and radii of curvature. Aero plans to couple these instruments with their Sur/Fax and Photo/File surveys. The new measuring tools are expected to be available for commercial use somewhat later.



● **LEGENDS on photo record of a section of highway identifies and locates the various defects in the pavement surface.**

MICROSTRAINERS

to Remove Insect Larvae

C. C. WILBUR

Chief, Water Works Section
Gannett Fleming Corddry &
Carpenter, Inc.
Harrisburg, Pennsylvania

IN THE SPRING of 1959, the Stamford Water Company of Stamford, Connecticut, suffered an invasion of *Chaoboridae* or "phantom gnats." They appeared in the distribution system as translucent larvae about one-half inch long. Their presence had been detected prior to 1959, but not in objectionable quantities. This time, however, the public was roused to righteous indignation by the sight of a white wiggler in a glass of water or a collection of them in the baby's bath.

The raw water supply is a surface supply collected in several reservoirs, with all water passing through the North Stamford Reservoir. The areas around the reservoirs are owned by the Stamford Water Company and the quality of the water is regularly checked by the Henry Souther Engineering Company. Suspended solids, color and bacterial counts have been normally low. Results of some analyses of the raw water indicate a most probable number of coliform organisms of 14. Copper sulfate is used regularly in all the reservoirs and breakpoint chlorination is practiced as the water flows to the distribution system. This does not kill the gnats but even if it did their presence in the water would still be highly undesirable.

The State Health Department was, of course, alerted to the situation. The assistance of the State Agricultural Department, under Dr. Robert C. Wallis, was enlisted to learn as much as possible about the life cycle of the phantom gnats. It was established that the wigglers start life as eggs in the bottom mud of the reservoir and, under favorable temperature conditions, the eggs hatch into the larvae stage. These larvae are then dispersed throughout the reservoir, finding their way into the distribution system. Those that do not get into the distribution system eventually emerge from the reservoir as flying insects.

There is still a mystery connected with the appearance of the gnats in

the delivered supply. Nearly all the complaints came from one very limited area. Sampling was done over the entire system and few larvae were found except in this area. A study of the distribution system gave no clue for their concentration in one place.

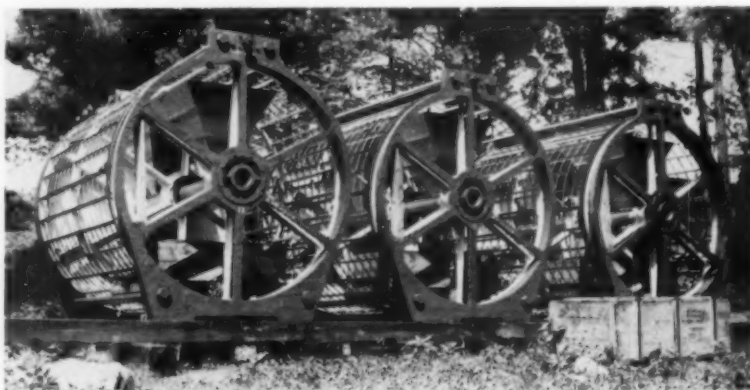
Removal of the larvae from the delivered supply is now the primary concern of the Stamford Water Company. The quality of the raw water is such that it does not require filtration. Therefore, straining of the water through a fabric with openings sufficiently fine to remove the larvae appears to be adequate treatment.

It was therefore proposed to the State Health Department that microstrainers be installed as the first step in an improvement program. It was proposed that if this first step does not produce a satisfactory water, the owner will proceed to step two, that is, filtration with small amounts of activated carbon. If necessary, a third step involving flocculation and settling, would be added. The program was approved by the State Health Department. It was estimated that for a normal capacity of 16 mgd, step one will cost \$530,000; step two \$2,785,000 additional; and step three \$975,000 additional. Step two includes large filtered storage and lagooning for wash water and future sludge. The construction of step one, which is estimated to represent about 12 percent of the total program costs, is believed to be all that will be required for many years.

The North Stamford Reservoir has served Stamford with adequate pressure by gravity for many years, but as has happened elsewhere, residents have begun to build in higher areas. Consumption has increased and this factor has also contributed to the drop in operating pressures due to added friction in the trunk lines from the reservoir. In 1954, a pumping station which pumps around a check valve was placed in service. It can raise the head in the system about 50 feet. One or more pumps are now used throughout the daytime period. The high service portion of the system will not be disturbed by the new construction.

The head loss for the entire microstraining system will be about seven feet. The loss through the strainers themselves will be about only 6 inches and that through the valves, piping, etc. about 18 inches. The remaining five feet is due to taking the water from the reservoir five feet below the overflow line. This 7 feet of head is lost, as the microstrainers do not operate under a head.

If, as an alternate to microstrainers, filters were to be constructed, as is proposed for step two, additional pumping head would be required and would entail the installation of new pumps and additional power costs. Further, the topography of the available area is such that there would be considerable loss of head between the reservoir and filters, thus adding to the pumping costs. Another consideration in the comparison between microstrainers and filters is operating costs. The microstrainers are virtually automatic and can be operated with a minimum amount of labor, while a filtration plant would require a considerable addition in manpower.



● THREE Microstrainers, shown before installation, each of 10 mgd capacity, were utilized to remove insect larvae which caused numerous complaints by the consumers.

After weighing all factors, it was decided to install microstrainers even though it means the loss of seven feet of head.

Microstrainer units can be obtained of various sizes up to a diameter of 10 ft. and length of 10 ft. The capacity of the microstrainers depends upon several factors and, for a 10 by 10 foot unit, may vary between 5 and 10 mgd. It was determined that three of these largest units would properly serve the Stamford Water Company. Space has been provided for a fourth unit.

The installation required a new line from the reservoir to the microstrainer building. An inlet chamber and screen building were constructed at one side of the reservoir by lowering the pool five feet and constructing a coffer dam of sheet steel piling and earth. Thirty-six inch mechanical joint piping was laid between the inlet building and microstrainer building.

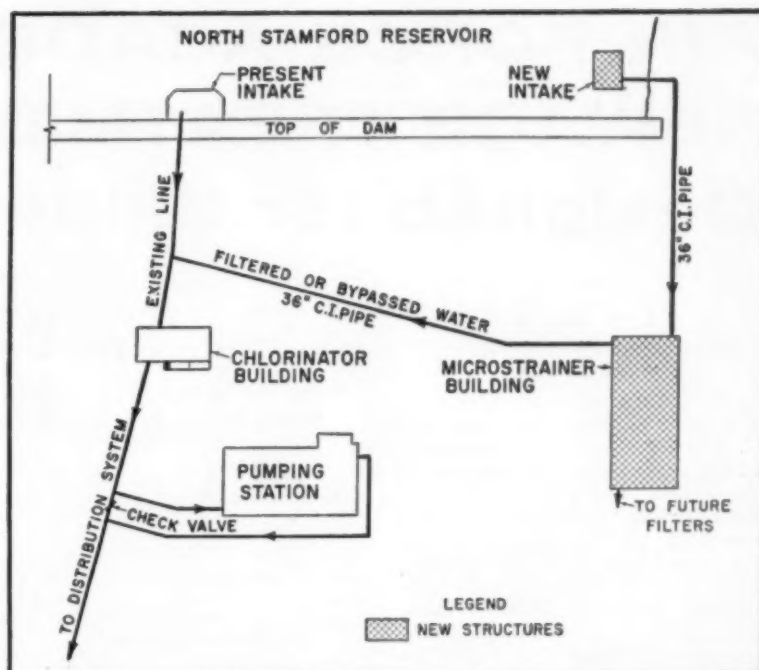
The microstrainer building is a two-story structure, 34 feet by 78 feet in plan, with the lower floor the operating floor for the microstrainers. The second floor will accommodate some minor equipment and a wash room and, if filters are added, will contain the chemical feeders and chlorine room. If filters are added, a third floor will be built for storage of chemicals. The building is on a steep bank with a slope of some 15 feet in its width of 34 feet. The foundation, however, is ledge rock so that stability of the structure is insured. Because of the steepness of the site, the entrance will be at the second floor.

Because power failures are rather frequent at this location and because particular care had to be taken to assure that the differential head across the strainers does not exceed 6 to 8 inches, the strainers will be bypassed automatically in case of power failure. The pumping station can operate at a 15 mgd rate without electric power, however, as a pump of that capacity is connected to a gas engine. The station has an emergency generator to provide light and power for the chlorinator pumps.

In addition to the three large microstrainer units a fourth unit 2½ feet in diameter and 2 feet long is being installed. This is a "package" unit and will receive the wash water from the larger units.

The microstrainers were purchased from Glenfield and Kennedy and were manufactured in Kilmarnock, Scotland.

The machine is a revolving drum filter operating in a rectangular tank



● LAYOUT and flow diagram at North Stamford reservoirs, showing how water was taken from new intake, passed through microstrainers and returned to existing line.

usually constructed of concrete. It has a cast iron end frame cast in a partition wall. This end forms the inlet chamber. The opposite end is solid cast iron and the two ends are connected by a hollow, galvanized steel axle which carries the revolving drum on ball and roller bearings. The two ends of the drum are also connected by cast bronze bars over which the micro fabric and supporting mesh are stretched and fastened down by monel metal straps and stainless steel screws. The strainer fabric, of stainless steel wire, in the 23 micron size has been selected for Stamford. This is equivalent to an aperture of about .001 inch. This fine fabric is supported by a 10 mesh stainless steel fabric.

Records indicate high efficiencies in the removal of microorganisms. The rapid build-up on the screen of a mat or "schmutzdecke" will retain material smaller than the fabric aperture. No appreciable removal of true colloidal matter or of color in solution can be expected by microstraining.

The machine has a galvanized steel hopper mounted on and opening into the hollow axle. Above this is a row of stainless steel jets spanning the width of the drum. A plastic cover over the jets confines the spray. The drum is driven by a 5 hp motor through a variable speed drive.

The raw water enters one end of the drum and passes out through the fabric. The drum is submerged to about 60 percent of its diameter and at the top of its travel the accumulated matter is washed into the steel hopper by the jets.

Normal pressure at the jets is between 10 and 20 psi and at Stamford the quantity of wash water required is estimated to be about 1 percent of the filtered water. Pressures up to 35 psi are being provided for occasional use to prevent build-up on the screen.

Care must be exercised to hold the differential pressure through the fabric to a matter of inches. Weirs are provided in the design to prevent excess differential. The operating speed will vary with the condition of the water, but is expected to be about 3 rpm or 100 feet per minute.

In Stamford the equipment is being installed on a somewhat unfavorable site and is not adjacent to either the reservoir or the pumping station which will receive the water. The complete installation will cost about \$34,500 per million gallons. If planned as a new project this cost should be much less. The manufacturer advises that the overall operating cost will be less than \$2.00 per mg. The equipment is very rugged, weighing 11½ tons per unit, and appears to be capable of long service with limited maintenance.

AIR FORCE ACADEMY SEWAGE TREATMENT PLANT Designed for Effluent Re-Use

J. H. BAUER

Robert and Company Associates,
Atlanta, Georgia

ABOUT ten miles north of Colorado Springs, Colorado, the U. S. Air Force Academy is located at the foot of the Rampart Range, the eastern slopes of the Rockies. Development of the Academy necessitated the development of all supporting facilities: housing, schools, stores, recreation and maintenance facilities. Total daytime population of the Academy is approximately 10,000. This figure includes the resident military personnel and their families, an 1,800 Cadet Wing, non-resident military personnel and civilian employees.

The Academy is developed over some 17,900 acres; at the northerly end is the Academic Area; housing, schools, stores and support facilities are in the central section; while the service area, headquarters for supply and maintenance, and the air strip facilities are at the southerly end. The three general areas are connected by encompassing roads. There is nearly 1,000 feet difference in elevation between the campus of the Academy at the northerly end and the buildings of the service area at the southerly end. The site is traversed from north to south by Monument Creek, one of the headwaters of the Arkansas River, with a drainage area above the Academy site somewhat in excess of 100 square miles. With an annual rainfall of about 17 inches and a very rapid runoff in storms of appreciable magnitude, there is a large portion of the year when streamflow through the site is very low.

Because of the limited rainfall and the planned landscaping of the site a large amount of irrigation was foreseen. As an aid in meeting the irrigation water requirements it was planned to utilize the effluent from the sewage treatment plant, bypassing the effluent to the creek only when it could not be accepted by the irrigation facilities.

The foregoing considerations led to the conclusion that a high degree of treatment would be required in

Table 1—Basis for Design

Design Population	Present	Future
Housed On-Base (incl. Cadets)	8090	14090
Housed Off-Base (8 hr. day)	3365	4175
Total	11455	18265
Design Flows, mgd		
Average Daily	0.91	1.53
Average 8-hour	1.11	1.78
Peak	3.34	5.35
Minimum 4-hour	0.40	0.50
Estimated Sewage Contribution, in pounds per capita per day, including allowance for ground garbage		
	Housed On-Base	Off-Base
5-day BOD	0.28	0.10
Suspended Solids	0.30	0.10
Ether Soluble Matter (grease)	0.12	0.05

Based on average daily flow this reduces to:

	Estimated Influent			Desired Effluent	
5-day BOD	2600 lbs/day	345mg/L	225 lbs/day	30mg/L(max.)	
			150 lbs/day	20mg/L(desired)	
Suspended Solids	2760 lbs/day	365mg/L	190 lbs/day	25mg/L	
Grease	1140 lbs/day	150mg/L	20 lbs/day	3mg/L	



Photos courtesy Elmco Corp.

● **GENERAL** view of treatment plant from the air. Plant utilizes two-stage high rate trickling filters. Garbage grinders will be installed in the 1244 housing units.

the sewage treatment plant—to provide an effluent that would be acceptable in the irrigation system or that could be discharged to Monument Creek at times when the rate of flow from the point might exceed the natural flow in the creek.

A second factor affecting the design criteria was the contemplated use of garbage grinders. Base housing was planned for 1,244 family units. Each unit would be provided with a garbage grinder.

Treatment by two stage, high rate trickling filters was selected with recirculation around both the primary and secondary filters. Design of the plant was based on criteria in the Engineering Manual, Corps of Engineers, U. S. Army and that of the Colorado State Department of Public Health. It is one of the requirements of the Corps of Engineers that military sewage works shall comply, insofar as possible, with State Health Department requirements.

The plant site topography and arrangement of units is such that gravity flow is obtained through the primary side. Pumping is required for the recirculation and to obtain flow through the secondary side of the plant. Should there be a power failure of appreciable duration at least primary treatment of sewage through the first stage of filtration could be maintained. Primary and secondary clarifiers and primary and secondary filters are provided as dual units. Single units of each may be shut down or taken out of service without disrupting the treatment process.

Sewage enters the plant through a bar screen chamber and com-

Table 2—Operation Results

	Sewage Flow, mgd			Relative Stability, %	5 Day BOD, mg/L		Susp. Solids, mg/L		Effluent DO, mg/L
	Avg.	Max.	Min.		Raw	Final	Raw	Final	
1959									
Oct.	1.192	1.374	1.070	89	372	11	303	13	7.7
Nov.	1.219	1.504	1.090	86	382	38	186	16	6.5
Dec.	1.055	1.337	.873	80	322	45	204	35	7.0
1960									
Jan.	1.110	1.376	.876	84	450	51	239	30	6.1
Feb.	1.074	1.195	.929	84	376	29	301	9	7.5
Mar.	1.226	1.555	1.987	85	348	30	228	12	6.4
Apr.	1.219	1.324	1.049	84	354	28	228	16	4.8
May	1.163	1.305	1.027	85	337	18	339	17	5.4
Jun.	1.073	1.258	.780	83	372	25	246	12	6.1
Jul.	1.234	1.426	1.091	88	388	18	247	6	6.8
Aug.	1.217	1.444	1.108	87	388	21	243	9	6.8
Sep.	1.217	1.922	1.043	85	314	38	178	27	8.1

minutor, a grit channel and metering flume. The flow normally is then divided and is passed to the primary clarifiers. Clarifier effluent is combined in a junction box and then again divided to go to the first stage filters. Effluent from the filters flows to the primary recirculation well. Three recirculation pumps provide for varying rates of recirculating the flow to the junction box ahead of the first stage filters.

Flow from the first stage filters can be bypassed to a main line discharging to the creek. Overflow from the primary recirculation well is also to this bypass.

Normal flow from the primary recirculation well is over a weir to the secondary recirculation well where four pumps provide flow in varying rate to the secondary or second stage side of the plant. This

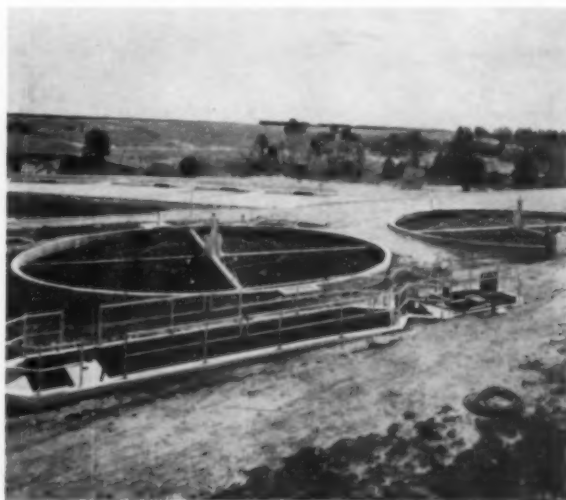
flow is then divided as it goes to the second stage filters and is again brought together in a junction chamber following the filters. Here an adjustable weir and an orifice on the recirculation line control the recirculation around the second stage filters. Flow over the weir is divided to the secondary clarifiers.

Effluent from the final clarifiers is to an effluent meter chamber, thence to a post chlorination contact chamber where, by baffling, complete mixing and sufficient contact time is obtained to permit full effect of the chlorination. Flow from this chamber is normally to the irrigation system; although should the irrigation facilities be unable to accept it, then the flow is over a weir with discharge into the creek.

Raw sludge from the primary clarifiers is pumped to the two di-



● CONTROL building is in center; primary filter is at the left. Parshall flume and meter are in right foreground.



● COMMUNUTOR and grit removal units are shown in foreground and beyond them are secondary filters and sludge beds.

gesters which may be operated either in parallel or in series. Supernatant is returned to the primary clarifiers and secondary sludge may be returned to the digesters or to the primary clarifiers. Digested sludge is dried in sand beds, the filtrate passing to the plant effluent line and the sludge cake being used as soil conditioner and top dressing on areas throughout the base.

Equipment in the digester control building permits the use of digester gas in the heat exchanger for heating the sludge in either or both digesters. Should digester gas be insufficient the deficit is made up with natural gas available on the base. Surplus digester gas is burned in a waste gas burner.

The plant was completed in November 1957 and, after leakage tests and mechanical tests for equipment operation were complete, was shut down until the base was activated. The plant was put into operation in June 1958.

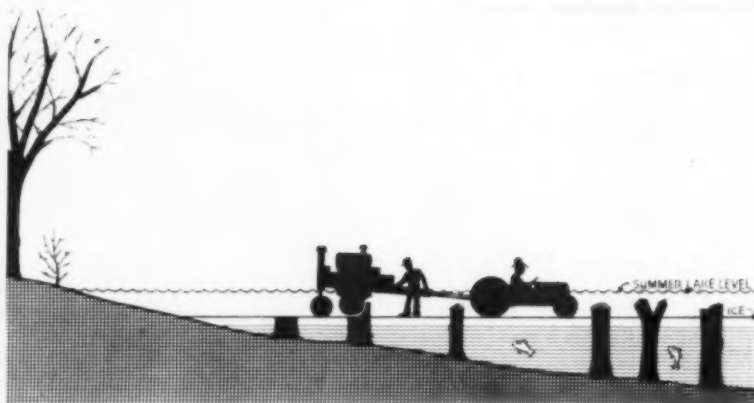
Design of the plant was by Robert and Company Associates of Atlanta, Georgia, as a subcontractor of Skidmore, Owings and Merrill, Chicago, Illinois, the Architect-Engineer for the Academy. Supervision of design was directed by E. C. Lendenmann, Chief of the Civil Branch of the U. S. Air Force Academy Construction Agency.

The plant is in continuous operation, individual units being taken out of service as required for maintenance. Operation is in three shifts, each shift has one operator and there are two relief operators for weekends. The day operators are assisted by three laborers during the week. The crew and operation is under the direction of the Sewage Treatment Plant Foreman, Mr. John W. Outlaw. Plant operators are Messrs. Bryce M. Davis, Harold M. Fogler, Ralph W. Gentle, Calven F. Maytubby, and Glen C. Pittman. Laborers are Messrs. Fred Frank, Jr., Forrest E. Hackenberry, and Floyd A. Holton. Plant operation, maintenance, repair, and modification is handled through Mr. Outlaw and his crew. General supervision is provided by Mr. W. C. Moore, Utilities Superintendent and Mr. Roy J. Stadlbauer, Sr., Sanitation Engineer. This staff is accomplishing a highly commendable operation.

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Revenue Water in Detroit

Of the water pumped into the mains by the Detroit, Mich., Water Department in the year ending June 30, 1960, 89.39 percent represented revenue water or water sold.



LAKE BED CLEARED by Stump Cutter

JAMES W. SMITH

Field Landscape Architect,
Huron-Clinton Metropolitan Authority,
Detroit, Michigan

A VERSATILE machine, the Vermeer stump cutter, has helped solve the problem of lake bottom clearance and stump removal at one of Michigan's largest recreational sites. The shoreline along Kent Lake in Kensington Metropolitan Park was dotted with unsightly stumps which presented a hazard to boaters during the spring, summer and fall seasons.

Located 33 miles northwest of Detroit along the Grand River Expressway, Kensington is one of the most popular parks in southeastern Michigan. With over 1,800,000 visitors annually, this 4,500-acre park is one of several recreational sites of the Huron-Clinton Metropolitan Authority, a five-county park and parkway agency which serves Livingston, Macomb, Oakland, Washtenaw and Wayne counties.

Kent Lake, which covers 1,200 acres, has a "backwoods" type of setting that is ideal for fishing, boating, swimming and other outdoor activities, including in the winter ice fishing and skating.

One of the most costly and difficult jobs in constructing a man-made lake of this size is the problem of lake bottom clearance and stump removal. The task of stump removal and disposal at Kent Lake was almost impossible because the soil in the impoundment basin is so

swampy in nature that bulldozer equipment sank almost out of sight when attempting to remove freshly cut stumps. Accordingly, all stumps were cut at the 880 contour line, giving a water cover of three feet with the lake at the normal summer level of 883 ft.

In designing the main dam structure it was felt that provision for a three-foot winter drawdown would be a desirable feature, allowing a flood control factor for down-river areas and giving winter protection for dockage plus the opportunity for shoreline clean-up in the fall and winter.

Since 1947, when the lake was completed, the stumps have become increasingly an eyesore in the winter when the water level is low; also they have become more exposed than ever due to the washing away of soil and heaving by the ice. In the summer the stumps present a hazard to outboard and sailboat operators who often run into them in shallow bays or other marginal areas of the lake.

Many Cures Tried

Authority officials attempted to reduce the stump problem and various clearance methods were attempted, but the results were only partially satisfactory. The methods used included winching from shore, dynamiting, bulldozing and sawing. Of the methods listed, the most successful was sawing, but it presented limitations because the cut could not be made low enough. It was also evident that accumulations of sand

were imbedded in the stumps, due to immersion, thus causing the chain saw teeth to wear out in an astonishingly short period.

About this time the Authority purchased a Vermeer Pow-R-Stump Cutter, Model 10. This machine was intended for use by the Authority forestry department in removing stumps in picnic areas, golf courses or elsewhere in the parks wherever stumps were unsightly or where they interfered with normal maintenance procedures, including mowing, leaf removal and seeding.

In the winter of 1959-60 the Authority tried the Vermeer stump cutter for the first time on the stumps in Kent Lake. Officials were astonished to find that in forty working days the machine cut some 2,000 stumps, most of which averaged 8-in. in diameter. These were cut at ice level or slightly below. This project was accomplished by using the C-12 cutting wheel with a double tooth pocket set-up and standard cutting teeth. The machine proved to be excellent for a project of this type. It will cut an average of 300 stumps per set of standard teeth using the double tooth set-up, which provides for more uniform wear, less vibration, a smoother cut and faster work on all kinds of stump cutting.

Authority officials are certain that this added duty assigned to the Vermeer stump cutting machine will result in a more attractive lake in the winter months, with fewer broken outboard propellers and damaged boats.

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World's Largest Prestressed-Concrete Reservoir

The world's largest prestressed-concrete reservoir, 28 million gallons capacity, will be constructed at Alderwood Manor, Snohomish County, Washington. It will be 370 ft. in diameter with 27½-ft. high walls. It will have a "dished" bottom which will hold about 25 percent of the tank's capacity. The reservoir will be unroofed and will cost nearly \$600,000. It will be constructed by the Preload Co.

Rasmussen & Beck, Seattle, Washington, are the general contractors. Consulting engineers are Gray & Osborne, Seattle & Yakima, Washington. Alderwood Water District Commissioners are: C. P. Ballard, Chairman; James Davis, Secretary; Nile A. Patterson, Commissioner. Mike Lindbloom is Water District Superintendent and Les Erikson is Water District Engineer.



● WATER line of reservoir was cluttered by many stumps, which were unsightly and precluded full use of reservoir for recreation. Photo taken in fall of 1960.



● BEFORE: Lake level has been lowered in preparation for winter. The stump removal unit is shown at the left getting ready to start work on typical shore section.



● CLOSE-UP of stump that was cut back in previous year. Water has been lowered for the winter season. At summer level, there will be 3 ft. of water over the stump.

Memphis Provides High Standards of STREET LIGHTING SERVICE

JOHN T. DWYER

Commissioner of Public Service
Memphis, Tennessee

FROM ITS EARLY beginning Memphis, Tennessee, located on the broad highway of the Mississippi River, has attracted traders and visitors from all parts of the world. Growing from a trading center, Memphis has, for years, exhibited unusual pride and attention to its civic affairs. Today, at the respectable age of 111, it offers one of the best examples of good government and good business management.

That street lighting has, for a long time, received prominent attention is attested to by the fact that two of the first electric utilities operating in Memphis devoted their services exclusively to street lighting. The first company, the Brush Electric Light & Power Company, was organized in 1882, and was followed soon after by the competing firm of Memphis Thompson-Houston Electric Light Company, organized in 1886.

In the next 36 years not less than five operating utilities were either originated or formed by consolidation. The last private operator, the Memphis Power & Light Company, took over utility operations from the Federal receiver in 1922. It operated the gas and electric service until the company was purchased by the city in 1939, who reorganized it as the "Memphis Light, Gas and Water Division".

Recognizing the importance of separating the functions of the utility business from that of the city's normal political function, the citizens are represented by the writer who, as Commissioner of Public Service, serves as liaison between the Memphis Light, Gas and Water Division and the Board of Commissioners of the City of Memphis. Under the direction of the Commissioner of Public Service, the office of the illuminating engineer, George Kincaid, functions full time on street lighting matters for the city.

It is through the office of the illuminating engineer that the location of installations, the type of

Table 1—Increase of Luminaires in Street Lighting Service

Year	Total Lights in Service	Average Size of Lights
1950	11,527	248.23 Watts
1951	12,310	253.33 "
1952	13,319	257.85 "
1953	14,313	274.87 "
1954	15,602	265.11 "
1955	16,724	269.77 "
1956	18,386	273.21 "
1957	19,598	280.89 "
1958	20,435	282.61 "
1959	21,352	285.64 "
1960	23,206	289.14 "

street lighting standards, and the lumens desired are determined. These plans for street lighting development are coordinated with the Memphis Light, Gas and Water Division through the Division's street lighting engineer. That this method has been effective in providing a uniformly graduated service for the various areas and uses is readily evident. Memphis, in spite of its commercial importance, can-



● CONCRETE standards with 500-watt lamps are on the Union Avenue Viaduct. Memphis streets have 23,206 lighting units.



● TYPICAL business section steel pole and luminaire. The city claims a light for every 21 people within city limits.



● NORTH PARKWAY lighting utilizes concrete poles carrying 500-watt, 10,000 lumen lamps. These are some of the 7,217 concrete poles in service throughout city.

Table 2—Distribution of Luminaires by Lamp Size

Number	Lamp Type	Watts	Lumen Size	Arrangement and Spacing
113	Inc.	750	15,000	80-90' opposite
1,932	Inc.	500	10,000	100' staggered
16,219	Inc.	300	6,000	100' staggered*
2,675	Inc.	200	2,500	200' on one side
2,311	Inc.	Below 200		
90	Mercury	400	21,000	

*This figure includes Crump Boulevard on which luminaires are spaced 75 ft. and arranged opposite.

not be accused of putting all of its light bulbs in the business area.

It should be stated that relighting of the downtown area has, by plan, had to await the completion of the expansion and upgrading of the residential and traffic arteries. As these streets are brought up to better than ASA standards, it is planned to upgrade the business area lighting. The latter, still a new system by many standards, has suffered, not in maintenance, but only by the development of more efficient light sources and methods of application, in the somewhat less than twenty years since installation.

Operation of the street lighting system is but one of the many services performed by the Memphis Light, Gas and Water Division. The officials, other than the commissioner of public service and the illuminating engineer, primarily responsible for the high standard of this service are: Ray Morton, president; W. R. Moyers, Jr., vice president; C. S. Beatus, executive director; C. L. Osenbaugh, director-electric division; J. C. Bradford, street light-

ing engineer; and J. F. Fossick, electric distribution engineer.

In providing the grade of lighting required in this city of over 500,000 people, the division maintains a total of 23,206 lights on the public streets. This ratio of one light for every 21 people is higher than that found in most cities.



● TYPICAL residential area lighting. Throughout the city, average lamp size is 287 watts and average lumens per lamp is 4,300, varying from 2,500 to 21,000.

In the matter of actual light provided, the city has an average lamp size of 287 watts, a figure nearly twice that found in some metropolitan areas. Figured on the basis of typical multiple street lighting lamps this indicates an average lumen output per lamp of 4,300. The electrical demand of the street lighting system is given as 7,000 kw. The distribution of luminaires by lamp size is shown in Table 2.

In the matter of appearance the city's plan of making the installation fit the area and the service, results in the use of 7,217 concrete poles, 1,596 steel poles and 13,571 luminaires mounted on wood poles. Because of the closer spacing on boulevards and business streets, the length of streets so equipped takes on a somewhat different proportion as shown in Table 3.

Table 3—Miles of Streets Using Lighting Poles of Various Types

Type of Pole	Miles of Streets
Steel, Ornamental	10
Steel, Trolley	22
Concrete, Ornamental	366
Wood	682

The "Division" was in the early vanguard in the conversion of its electrical system from series to multiple, and, as a consequence, has employed several types of control for the system operation. At present only a few series circuits remain in service.

What's ahead for Memphis in street lighting remains to be fully determined but, in general, it is planned to make more use of gaseous discharge lamps in order to bring still greater benefits in the form of higher illumination efficiencies to the people of Memphis.

Sanitary Aspects of WATERSHED MANAGEMENT

In this article, the editorial staff of PUBLIC WORKS has summarized the salient points of a report adopted by the Arkansas-White-Red Basins Inter-Agency Committee in November, 1960, entitled "Guidelines for Reservoir Sanitation." The AWRBIAC is composed of representatives of seven Federal agencies concerned with river basin development and representatives of the States of Arkansas, Colorado, Kansas, Louisiana, Missouri, New Mexico, Oklahoma and Texas. Concerned with the sanitation problems which might result from recreational and other uses of watercraft and lakeside properties on the many new reservoirs developed in the eight States, the committee organized a work group to study the problem. The resulting report was "prepared for the purpose of recommending good practices and guidelines for reservoir sanitation and reflects the effort and thinking of State and Federal agencies concerned . . ." The complete text of the "Guidelines" is 25 typewritten pages. Mimeographed copies in limited numbers may be obtained without charge from J. Roy Penix, Sec'y, AWRBIAC, c/c Corps of Engineers, 1114 Commerce St., Dallas 2, Tex.

SINCE OVERALL watershed management involves many interests, any developments planned and activities likely to occur which might affect water quality should be coordinated with the state and/or local health department. In many phases of these problems, existing standards of state health departments will apply. For instance, in the provision of water, requirements will be the same whether in mountain or lakeside areas.

Sanitary Protection for Reservoirs

In order to protect the sanitary and chemical quality of impounded water used for municipal water supply, and considering the extent of recreational activities which may be permitted, the following broad policies should be considered: Satisfactory sewage disposal facilities should be provided, consistent with the requirements of the respective State, by all habitations on the watershed. Sources of excessive pollution should not be permitted. It is advisable to make routine bacteriological, biological, limnological, and other requisite investigations of the raw water supply and its tributary streams to determine if pollution is occurring.

The location of water intake structures is within the jurisdiction of the state health department and its consultation and guidance should be sought. In general, a restricted

zone of one-half mile radius from the raw water intake works should be established and recreational activities such as swimming and water skiing should be prohibited in this area. The restricted zone should be appropriately indicated by buoys or other markers and signs.

Necessary waste treatment facilities within the immediate vicinity of raw water intakes should be in

accordance with the requirements of the appropriate health agency.

Sewage Disposal

Federal, state and local agencies should encourage and promote programs for the preservation of the surface and ground waters in recreational areas in the interests of public health and welfare, conservation of fish and wildlife and recreational development. Objectives should be to preserve water quality in a manner consistent with reasonable and beneficial future development.

Important items to be considered in the construction of a sewage treatment plant are:

- 1) Location of plant with reference to habitation and recreational areas, bathing beaches, etc.
- 2) Ultimate disposal of the effluent with regard to receiving water courses, proximity of bathing areas and water supply intakes.
- 3) Volume, type and strength of wastes to be treated.
- 4) The quality of effluent desired.



● TYPICAL recreational use of one of the larger reservoirs. This view shows Whitney Reservoir, with Whitney Dam in the background, on the Brazos River in Texas.

5) Simplicity of operation and maintenance of treatment facilities.

When the volume of sewage is not excessive and the terrain and soil are suitable for the disposal of a septic tank effluent by subsurface means, the installation of a septic tank and subsurface disposal field is economical and practical. Percolation test procedure and the disposal system design should conform to the respective State requirements. In the absence of state bulletins on the construction of septic tanks, The Public Health Service "Manual of Septic Tank Practice" should be followed.

Installation of approved - type earth-pit privies, vault privies, and chemical toilets for developed areas such as campgrounds, picnic areas, etc., should be made only where the installation of modern sanitary facilities is considered impractical. Recreational area developers should be encouraged to provide modern sewage disposal facilities wherever possible. Non-water-carriage sewage disposal facilities should conform to the respective State health agency requirements.

The projected populations which will use recreational areas at multipurpose reservoirs are extremely difficult to estimate. As a control measure, provision should be made for temporary portable emergency facilities until additional permanent units are constructed.

Piers, Barges and Water Craft

The treatment of sewage wastes from piers, barges, vessels and other craft on a reservoir should be in accordance with regulations of the State Health Department.

State regulations and/or legislation are to be encouraged that will place restrictions upon the use of houseboats and cruisers; govern disposal of sewage from these craft; and regulate the use of marine toilets. These "Guidelines" do not present recommended practices and standards for sewage treatment devices for marine toilet waste, including their installation, since their practicability might be questionable in the absence of generally accepted equipment and methodology.

Galley refuse should be stored in an approved container and disposed of at sanitary sites on shore. If approved by the State Health Department, the organic wastes may be macerated and discharged to the lake or to an acceptable treatment device. The liquid waste from a vessel should receive treatment con-



● LAKE TEXOMA, Eisenhower State Park, Texas. The concentration of visitors in such an area will require initiation of sound measures for preventing various diseases.

sistent with the requirements of the State Health Department.

Adequate retention tanks should be provided on piers and stationary barges for the collection of wastes. The wastes should be pumped to an acceptable location on the shore for disposal at facilities approved by the appropriate State agency in a manner that precludes the possibility of wastes reaching to the reservoir.

Refuse Sanitation

Storage—All refuse should be kept in durable, watertight, non-absorbent and easily washable receptacles equipped with close-fitting lids and adequate handles. The capacity should not exceed 30 gallons. Sufficient containers, conveniently located, should be provided to hold all garbage and refuse that accumulates between collections. Refuse receptacles at food-service establishments should be kept on concrete slabs or elevated metal stands located on the premises and easily accessible to the collector.

Collection—Refuse should be removed from the premises as frequently as necessary to prevent nuisances. Frequency in servicing should be flexible; however, in general, the following periods are suggested:

- 1) Daily for large food-service establishments.
- 2) Daily to once or twice weekly, as necessary, for picnic areas, campgrounds and parking areas.
- 3) Daily from boats, barges, piers.
- 4) Twice weekly for residential areas.

Refuse receptacles should be kept clean. Collection vehicles should conform to the requirements of the responsible agency. Generally, refuse bodies should be covered and leak-proof.

Disposal—There are three methods of garbage and refuse disposal that are considered satisfactory from a public health standpoint. They are: (1) Sanitary landfill; (2) incineration; (3) garbage grinding with discharge to the sewerage system.

Burning refuse in recreational areas may require caution because of the fire hazard. The methods herein described are for community service and not necessarily adaptable to individual disposal. Burial is an acceptable and safe method of refuse disposal from an individual premise. Burning should be considered only when burial is impractical and fire hazards are minimal.

Rodent Control

There are several methods for eradicating rats. No one method can be used universally, therefore, each of the available methods should be considered.

A good environmental sanitation program includes proper refuse disposal and food storage, with harborage elimination. Sanitation is essential and the use of rodenticides should be regarded only as supplementary to sanitation.

The ratproofing of all new buildings would be desirable at recreational area developments where rats and/or wild rodents are prevalent.



● PINE CREEK Cove State Park in Oklahoma. Concentration of visitors again emphasizes the necessity for applying sanitary aspects of watershed management.

Rodent control methods should be initiated and the ratproofing of existing buildings should be considered where rats and wild rodents are a serious problem. The value of ratproofing existing and new buildings in noninfested areas, or where rats are not prevalent, is questionable. Environmental sanitation measures should prevent infestations.

Poisoned baits are often the most dependable method of rat eradication. Anticoagulant rodenticides are relatively safe for use around warm-blooded animals but all rodenticides are potentially dangerous. Poisoning and trapping should be considered only as supplements to antirrat sanitation and exclusion. Fumigation should be conducted only by trained personnel.

Traps are indicated when poisoned baits may be dangerous; when it is especially desirable to avoid odors from poisoned rats that die in inaccessible places; and when rats may have become "wise" to poisoned baits.

Animals other than rodents may be a problem or nuisance in public use areas. While good sanitation practices may help, they are not effective control measures. Control of these animals may be desirable, especially if rabies is endemic in the area, in which case, services of specialists in this field should be obtained as necessary.

Insect Control

The principal vector control problem associated with water impound-

ments will be to prevent or minimize the development of mosquito-producing areas in any portion of the reservoir within mosquito flight range of human populations. This may be accomplished by a well coordinated vector control program during the planning, construction and operational phases of the reservoir.

Any of the following conditions associated with reservoirs will favor the production of mosquitoes:

- 1) A flat shoreline.
- 2) Emergent and/or floating vegetation in shallow water areas.
- 3) Heavy accumulations of floating debris in shallow areas and embayments that are protected from wave action.
- 4) Undrained depressions, borrow pits, sloughs and swamps within the fluctuation zone.
- 5) Rising or constant pool levels that cause the water to remain in the marginal vegetation for more than four or five consecutive days during the mosquito breeding season.
- 6) Marshy seeps below the dam or dike.

The following general procedures are recommended for mosquito control.

Reservoir Clearing—Generally, before impoundment, clearing is necessary within one mile of urban population centers and rural population groups and within one-half of recreational areas. Clearing may be minimized in areas lacking access of people and in areas with sparse vegetation along abrupt shorelines

which will be exposed to wave action. Elsewhere, trees and other growth should be removed between the minimum summer pool level and the normal pool level. After impoundage, vegetation of a type and density favorable for mosquito production in flat, protected areas within the normal summer fluctuation zone of the conservation pool should be periodically controlled by mechanical or chemical measures. Vegetation, debris, and flottage should be removed periodically from all mosquito control and other drains to insure free flows. It is difficult, however, to indicate rule-of-thumb measures regarding clearing, and each reservoir should be evaluated individually.

Water Level Management—Provisions should be made for favorable water level management schedules for mosquito control to the maximum degrees which the primary functions of the reservoir will permit. A surcharge as high as practicable in the spring followed by a sharp drawdown would be of much value in stranding flottage and drift. An overall seasonal recession of the pool level of about 0.1 foot per week, during the mosquito breeding season, would benefit control.

Borrow areas should be located where they will be permanently inundated, if possible; or if in the fluctuation zone or outside the reservoir basin they should be self-draining. Drainage ditches should be installed for marshes, sloughs and depressions in the normal summer fluctuation zone of the conservation pool so that they will drain or fluctuate with the main lake for mosquito control.

Public Use Areas—As a general principle, recreational areas should be located along sections of the reservoir where the mosquito breeding potential is low. Recreational areas with facilities for night occupancy should be at least 1½ miles from wildlife areas which might have a high mosquito breeding potential. If it becomes necessary to locate such wildlife areas in close proximity to populated areas, provision should be made for adequate mosquito control measures in areas where night occupancy is planned.

Entomologic Surveillance—Entomologic evaluations should include, if possible, periodic observations on the species of mosquitoes present and their relative abundance over a period of one or more seasons prior to impoundage. Such observations will provide a basis for comparing mosquito production

prior to impoundage with that after impoundage-control procedures.

In situations where it is impossible to carry out effective preventive measures, and/or when entomologic inspections reveal that mosquitoes constitute a health problem, appropriate chemical control measures should be inaugurated, either adulticiding or larviciding operations and in some cases both. Where a domestic water supply is involved, chemicals for vector control should be applied in accordance with State Health Department recommendations.

Biological Considerations

A reservoir is constructed to serve one or more useful purposes. The biology of reservoirs is dependent upon and affected by the environment which is largely determined by characteristics of the influent water, type of reservoir constructed, and operating conditions. The deposition of silt and other solids, shoreline and marginal area changes and nutrient characteristics of the water provide a constantly changing environment. The vegetation, algae, fish and other animal life respond to the environmental conditions and may become serious problems if allowed to grow unchecked by either natural or artificial controls.

The development of profuse algal growth should be limited insofar as practicable by preventing excessive fertilization of the water as discharge of domestic wastes or of industrial wastes containing nitrogen and phosphorous and other nutrients.

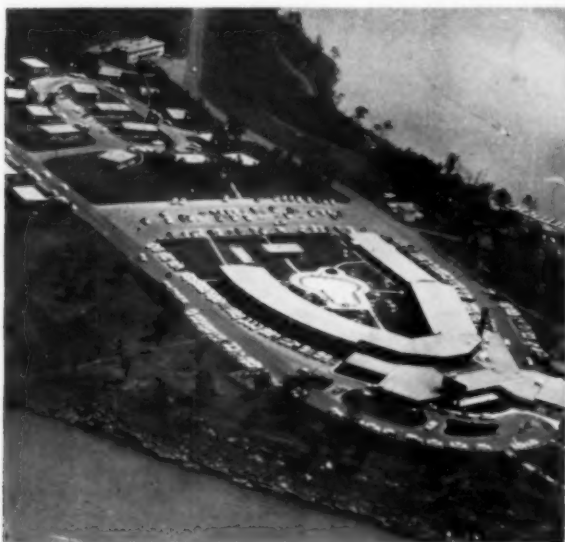


● LITTLE recreation attendance was originally anticipated at this small reservoir (94,000 a-f), yet inland lake enthusiasts made 1¼ million visits during 1960.

In the shallow marginal and shoreline areas, aquatic vegetation can be a serious detriment to recreational facilities, and other uses. Normally, little can be done to shoreline areas to prevent growth of vegetation with reasonable expenditures except chemical control measures in limited areas for certain vegetation after it has become a problem.

The use of chemicals to control fish, vegetation and algae and to prevent evaporation of water is being practiced or possibilities for

their use explored. Rotenone and associated solvents and synergists are used to control fish populations. A large variety of chemical agents are available for the control of algae, aquatic vegetation and marginal growths. The toxicity of these chemicals to plants, fish and humans varies widely. The use of any chemical must be carefully considered as to its effect on other biological life and reservoir uses and it should be employed in accordance with State Health Department recommendations.



● ONE of the fine resorts constructed by the State of Oklahoma on C of E reservoirs and the State-operated Lake Murray.



● FISHING barge takes parties out on Belton reservoir, Leon River, Texas. Large groups can create many sanitation problems.

TUNNEL SOLVES TRAFFIC CONFLICT BETWEEN RIVER AND ROAD

This report is a contribution from **HARRY T. JONES**, who is a professional writer and photographer on technical subjects.

FLORIDA's first vehicular tunnel became a reality with the recent completion of the New River Tunnel in Fort Lauderdale. In the planning stages for more than 10 years, the tunnel carries the traffic of U. S. Route 1 (Federal Highway as it is called in Fort Lauderdale), the main highway linking the north with Florida's Gold Coast. It is a major local artery as well. The cost for the complete project was \$6.5 million.

U. S. Route 1 splits Fort Lauderdale, running north and south. Close to the center of the city it meets narrow New River, an equally important marine artery for yachts and work boats in this city of waterways.

A decrepit swing-span bridge, vintage 1928, once creaked open and closed to permit alternate flows of river and car traffic; but marine right-of-way became too demanding and even a time schedule for bridge openings could not solve the problem during busy traffic hours. Demand for a tunnel became so strong that when construction finally was authorized, work was begun before all right-of-way had been acquired.

The twin tubes of the tunnel each provide a 24-ft., two-lane roadway. There is a pedestrian sidewalk on the east side of the east tube. At the point of crossing, New River is about 200 feet wide so the portal-to-portal length of the tunnel is but 864 feet, with open ramp approaches adding another 1,114 feet. The tunnel is posted for a 13.75-ft. clearance, though the actual inside dimension of the tubes is 14.25-ft. clear.

To keep river traffic flowing, the tunnel was built in two stages, the south half being completed first. The cofferdam was then removed and



Photo credit: Gene Hyde Associates

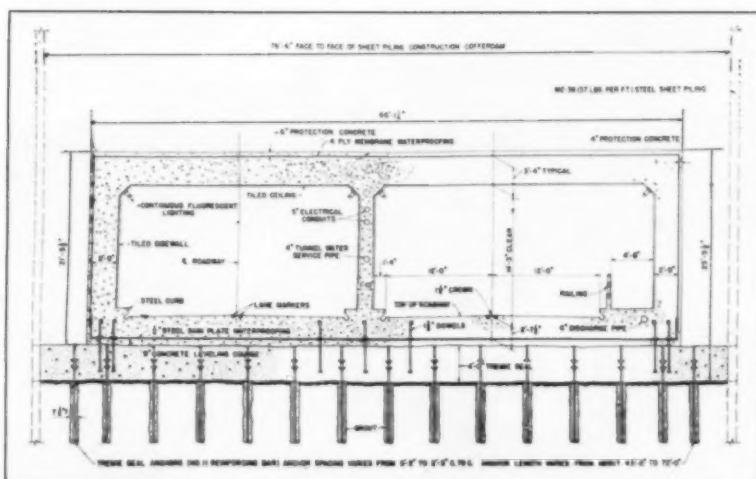
● **AERIAL view, looking north, shows second stage cofferdam in place. South half of tunnel had been completed and river traffic was routed over it at this point.**

the river traffic moved over the top of the completed part of the tunnel. The second stage cofferdam overlapped the completed portion of the tunnel by about 25 feet.

At the tunnel the river was some 25 feet deep. Beneath this lies a 20-ft. layer of soft, sandy limestone, but this rock layer was so thin and uncertain that it was disregarded

and anchor piles were driven into the underlying sand to a depth where friction values were sufficient to hold down the tunnel seals.

After the cofferdam was constructed the tremie seal anchors were driven from a temporary bridge, using oil well type pipe casing with a 7-in. outside diameter. Each casing had a steel cap at the



● CROSS-SECTION of tunnel showing the tremie seal anchors; the steel skin plate waterproofing and the details of the twin tubes to carry traffic under New River.

bottom, which remained in place when the casing was pulled. The anchors, varying in length from 43 to 78 feet, were formed by pouring grout into the holes as the casing was pulled. Reinforcing rods were forced into the grout before it had set.

Next a tremie concrete seal slab, 4 feet thick, was placed inside the cofferdam. Reinforcing for the slab, which has a maximum grade of 6 percent, was placed by skin divers. The slab was tied down by the grouted anchors and its weight also served as ballast to resist hydrostatic pressure amounting to as much as 3100 psf when the cofferdam was dewatered. Cable clips were used to increase the bond between the anchor rods and the tremie concrete seal slab.

To provide watertightness for the tunnel, a 1/4-in. steel skin plate 66 ft. wide and 1600 ft. long was placed on a 9-in. concrete leveling course above the tremie seal. Ordinarily membrane asphaltic waterproofing is used for this purpose, but in this case 3,100 dowels had to be placed

to tie the tunnel floor into the tremie seal for ballast, and holes through the membrane waterproofing would have destroyed this watertightness. The steel plate was welded to these dowels where each passed through it.

Testing Welds

Welding the equivalent of about 20 miles of joints without any leaks presented quite a problem. To solve this, the vacuum box method of testing was adopted. This method consists of placing a glass top box, of appropriate shape for the various conditions, over the welds which have been coated with soapy water. Under about seven pounds of vacuum a bubble will form if there is a leak. Leaks are then rewelded and retested.

A total of 5,200 piles were sunk for the tunnel and 7,200 grouted anchors were placed, including 4,100 hold-downs for the tremie slab. 3,100 dowels connect the tunnel floor and tremie slab.

Catch basins were installed at each portal with 3,200 gpm capacity

pumps designed to care for rainfalls from any hurricane or tropical storm. At the tunnel floor another 600 gpm can be discharged into the river from the mid-river pumps.

Since a portion of the tunnel roof lies above the river bed, a four-foot blanket of rock and gravel was placed as a protection against craft with too much draft to pass over the tubes. River depth at mean low water is 14 ft.

Described as completely automatic, the tunnel is a one man operation. Water pumps and venting fans are automatically controlled. Traffic signals are remote controlled and four telephones have open lines to the police department to summon help for motorists.

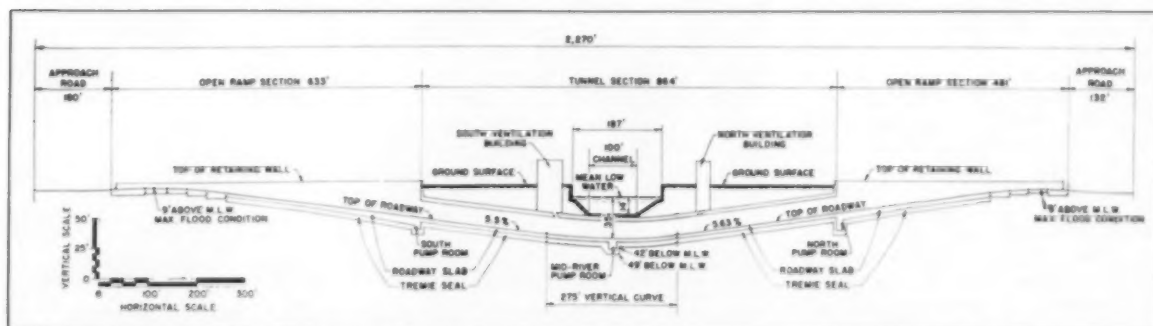
Each tube also has two fire alarm signals, six extinguishers and seven hose valves. The approaches are illuminated by ordinary street lighting standards. Inside the tunnel, at the top of each wall, there is a continuous row of fluorescent lights.

Right of way for the toll-free facility was provided by the City of Fort Lauderdale. Construction costs were shared by the Florida State Road Department and the Bureau of Roads.

Fire and police protection are handled by the city. The State Road Department operates the tunnel and will provide maintenance.

Tunnel traffic has topped advance estimates. For the period from January 12 through 18, 1961, the seven day average was 24,929 cars. More than 27,000 cars used the tunnel on the peak day—Wednesday—with Thursday registering a low for the week, but still over 23,000 cars. No hourly count has been made, but the rated capacity is 7,500 cars an hour.

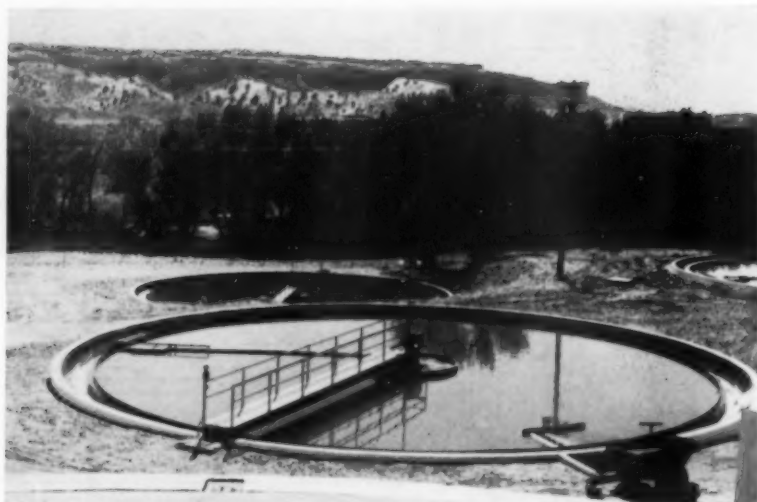
Contractor for the tunnel was the Thornton Construction Company. James E. Hood was project manager. E. V. Jones was resident engineer for Singstad and Baillie, consulting engineers.



● LONGITUDINAL section through tunnel showing stream channel, elevations, pump locations and ventilation arrangements.

● PLANT at Farmington is designed for 50,000 population. 80-ft. diameter primary is followed by complete treatment.

Courtesy Process Engineers



**With Good
Sales Work,**

PUBLIC LAW 660 Has Really Helped New Mexico

CHARLES G. CALDWELL

Director, Division of Environmental
Sanitation Services,
New Mexico Department of Public
Health

NEW MEXICO is a large state—the fifth largest in the Union; but it is dry and arid. It has a land area of 121,511 square miles. There are six climatic zones with an elevation range from 3,000 feet to over 10,000 feet. The population of the state in 1940 was only 531,818. By 1950 this had climbed to 681,187. Limited water resources were being strained to the utmost. In some areas, municipalities which had always depended on surface water supplies were forced to prospect for ground water. A few were successful, but often the ground water was too objectionable to use. In one instance the total solids content was over 1700 mg/L. In Santa Fe, the State Capital, the water situation once got so bad that there was only about one month's supply left in the city reservoirs when wells were hastily drilled and additional water obtained—hard, it is true, but wet.

Las Vegas, a neighboring town of about 12,000, got into a similar plight. The Gallinas River, always before a dependable source, completely dried up. Existing wells had very high iron contents. Exploration and development finally resulted in

a well supply that was satisfactory. Again the situation was solved, but just in the nick of time.

In the meantime the state was constantly growing. The population kept expanding as military establishments kept pace with the ever-increasing need for more personnel. New Mexico has many air bases and other types of military establishments. More oil and gas fields were found in the southeast corner of the state. Small towns boomed overnight. Large deposits of oil and gas were found in the four-corners area, the northwest corner of the state. Farmington jumped from 2,637 population in 1950 to 23,858 in 1960. No sooner was a new sewage treatment plant completed than a larger one had to be constructed; and when it was completed, it again had to be enlarged. Last year another renovation to permit handling the waste load of the still-larger population was finished. The water treatment plant has been doubled twice in capacity, and construction is now under way to provide still additional capacity. Throughout the area, towns were growing rapidly and some new ones were being developed.

Uranium was discovered near Grants, N. M., and later still, the ore was discovered in the Ambrosia Lake area. Trailer and auto courts were built almost overnight and again there were strains on the water and sewer facilities.

Despite the water shortages the state kept growing until by 1960 the population had increased to 943,980 people. The problem of water shortage was even more severe than these figures indicate. Not only was there a high influx of people from outside of the state, but there was a tremendous movement of people within the state from the rural areas and from depressed areas to the urban centers where employment was more readily obtainable.

The problem of water shortage also brought problems of water pollution. The New Mexico Oil Commission undertook the task of regulating pollution caused by oil field brines, leaving other types of pollution control to the Department of Public Health. More and more sewage treatment plants were needed with more complete treatment for discharge into rivers carrying dwindling quantities of dilution water. Passage of Public Law 660, the Federal Water Pollution Control Act, came at just the right time. It afforded the Department of Public Health a means of attracting interest in municipal waste treatment plants by contributing financially to the construction.

The three major rivers in New Mexico are the Rio Grande coming down from Colorado through the center of the State, to enter Texas near El Paso; the Animas River which also enters from Colorado below Durango, and after passing

Aztec, Farmington and Shiprock, enters Utah; and the Pecos River, with headwaters above Cowles, which wanders down the east side and leaves New Mexico below Carlsbad to enter Texas. Many of our major municipalities have been built along the banks of these rivers, and their waters are heavily used for irrigation through complicated systems of irrigation ditches and drainage canals.

When the first appropriation was made in 1956 under Public Law 660, we already knew where our weak spots were, so our plan of action was predetermined. We employed another associate engineer to administer the program and started out to sell sewage treatment to our municipalities.

The Pecos River

Our first project was in Gallup. Construction included a new interceptor sewer, a high rate trickling filter, pump station and a new primary clarifier. The total project cost was \$217,192, of which \$60,157 were Federal funds. The project was part of a long-range program for moving the sewage plant out of town.

Our second project was at Fort Sumner. They already had an overloaded Clarigester and high rate filter. Discharge was directly into the Pecos River, and during the irrigation season the dilution factor was very low. A completely new plant including primary and secondary treatment was completed in October, 1957. The new plant was located at a greater distance from centers of population than had been the old one. The cost of the plant was \$161,-

121, including a Federal grant of \$26,072. This new plant helped to improve conditions in the Pecos considerably.

Carlsbad, which has a sewage treatment plant discharging directly into the Pecos River, is a service and supply center for several large potash mining companies. The old plant was rapidly becoming overloaded, and the effluent was degrading the stream, which is heavily used for recreational purposes. In addition, the growth of the town was around the plant, so it was rapidly becoming a nuisance to new property owners. It was decided, therefore, to build a new plant in two stages across the river. The first stage was completed in May, 1959, at a cost of approximately \$523,458, including a Federal grant of \$156,681. Construction included a lift station, pressure line, two high-rate trickling filters and a secondary clarifier. Construction on the second stage may not start for some time, as the city government wants to see if the town population is going to level off or increase. The effluent line from the new plant drops off a high cliff. As a result, there is an enormous billow of detergent suds in the river at this point. Numerous fish were observed swimming around the foamy mass.

Santa Rosa was using an old overloaded WPA plant consisting of a modified Imhoff tank and a fixed nozzle trickling filter. Discharge was to the Pecos River. It took some selling, but finally the town was convinced that a new plant was needed. The project included an Imhoff tank, trickling filter, final clarifier and

sludge beds. Construction was finished in March, 1960, at a total cost of \$189,091, including a Federal grant of \$36,134.

Roswell has a fairly new plant, but the town has been growing rapidly, so an expansion program is planned. The plant is a separate sludge digestion plant and is very well maintained and operated. The proposed expansion will include an interceptor sewer, clarifier and trickling filter. The total estimated cost of the work is \$279,000, to be partially financed by a Federal grant of \$83,500.

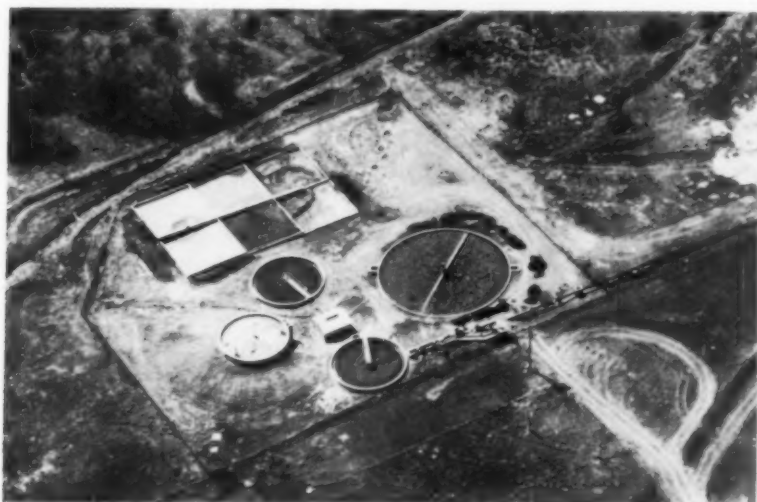
Artesia is just below Roswell. The existing primary plant and trickling filter are overloaded and efficiency has been greatly reduced. As a result, the town has approved a revenue bond issue to finance a new plant at a greater distance from the community. It is now under construction and will be a complete treatment plant estimated to cost \$311,665, including a Federal grant of \$90,000.

With new plants at Santa Rosa, Fort Sumner and Carlsbad, and upon completion of the work proposed for Roswell and Artesia, the Pecos essentially will have been cleaned up. There is one town of about 1,000 population which is still discharging raw sewage into the river. Actually, because of the large dilution factor at this point, this small contribution does little damage. We do wish, however, there were some way we could change their viewpoint and get some type of treatment plant constructed. Despite this one failure to get a plant built, we feel pretty good about the Pecos. Like the Rio Grande and the Animas, the Pecos is going to be a clean stream.

The Rio Grande

Project No. 3 was in Santa Fe. The plant effluent was discharged into a ditch. Some tourists, several years ago, while horseback riding, thinking the effluent ditch was a mountain stream, had paused to quench their thirst. The result was a case of typhoid fever. The ditch also attracted children who like to play in water, so it was deemed advisable to enclose the ditch in a pipe. The work was completed in October, 1958, at a cost of \$18,364, the Federal portion being \$4,514. The work included 3120 feet of 18-inch sewer. Much of the effluent is used to irrigate the local golf course.

Albuquerque had boomed in population to such an extent that the sewage treatment plant could not possibly handle the job. A one-million-dollar expansion program



Courtesy Dorr-Oliver, Inc.

● AZTEC plant includes mechanical bar screen, grit chamber, primary clarifier, high rate trickling filter, digester, secondary clarifier and outfall to the river.

was undertaken to build a plant for 200,000 people. The plant includes an oil separator, emergency by-pass for storm waters, new digesters, sludge heating equipment, sludge beds, a sewage gas power plant for providing electricity, primary and secondary clarifiers and equipment for the laboratory. The total project cost was \$1,062,600, including a Federal grant of \$250,000. Needless to say, the new plant has made a tremendous difference in the Rio Grande. It is a much cleaner stream now, as Albuquerque, the largest city in the State, was contributing the greatest volume of sewage. The effluent now goes directly to the river where there is more dilution.

Construction is already under way for another new plant located south of town. Albuquerque has already passed the 200,000 point and is still growing.

A project was undertaken at Las Cruces, also on the Rio Grande. The work included a new lift station, a 15-inch interceptor sewer, reconstruction of the existing trickling filter and construction of a new digester. The total estimated cost was \$252,252, which included a Federal grant of \$56,772. The new plant turned out a more highly refined effluent, a great help to the City of El Paso which takes water from the Rio Grande for domestic use.

New complete treatment plants had been built at Taos, Espanola, and Socorro prior to Public Law 660, so the Rio Grande essentially has been cleaned up from top to bottom.

The Animas River

Aztec draws its domestic water from the Animas River and then discharges its sewage back into the river not too far above the Farmington water supply intake. It was essential that a new plant be constructed for Aztec to protect the Farmington water supply. The city was easily sold, and as a result a new plant consisting of a mechanical bar screen, grit chamber, primary clarifier, high rate trickling filter, digester, secondary clarifier and outfall line were all constructed. The total cost was \$259,646, including \$63,429 of Federal funds. It has greatly improved conditions in the river and relieved the load on the Farmington water treatment plant.

Farmington discharges its sewage just below the town, near the confluence of the San Juan and Animas Rivers. People all along the river use the water for domestic purposes, including the Navajo facilities at Shiprock. The Farmington plant was badly overloaded, so practically raw sewage was going into the river. A project was initiated to provide sufficient capacity for 50,000 people. A complete plant including primary and secondary treatment was completed at a total estimated cost of \$621,120, of which the Federal share was approximately \$186,336.

Bloomfield, a new boom town located between Farmington and Aztec, is a supply and service center for the oil and gas companies. A new sewage collection system and treatment plant have just been com-

pleted. Discharge is to the San Juan River. The estimated total project cost is \$213,679 which includes a Federal grant of \$35,794. Completion of the plants at Bloomfield, Farmington and Aztec have cleaned up the San Juan and Animas Rivers in New Mexico. A uranium mill at Shiprock confines its wastes to lagoons to help keep the river unpolluted.

The Town of Grants expanded at a terrific rate due to the uranium boom. New Mexico has 65 percent of the known uranium reserves in the United States and 50 percent of the milling capacity. Most of the mining and milling is in the Grants area. Trailer courts and auto courts were mushrooming all over the area. A population of probably 10,000 was using an old Imhoff tank designed for 2500. The effluent was discharged to the Rio San Jose, a small stream that runs through an Indian Reservation. The Indians used the stream for domestic drinking water. To make matters worse, a new town, Milan, was constructed just adjacent to and upstream from Grants. Conditions in the river steadily worsened. A thick black carpet of sludge kept building up on the river banks. Complaints kept coming in about the very real hazard, and rightfully so. Being a boom town with an uncertain long-range business picture, Grants had difficulty obtaining financing, but finally after three or four frustrating years, funds were obtained.

Plans were developed and a new complete sewage treatment plant was built in 1959. In order to avoid having the effluent from Milan go through the Town of Grants, the new plant was designed to handle the sewage for both towns. The Grants plant cost \$273,534, including a Federal contribution of \$69,900. Two lift stations and an interceptor sewer were necessary to bring the sewage from Milan to the main line in Grants. The total cost of the work was \$163,501 including a Federal grant of \$48,216. The two towns drew up a contract whereby Milan pays Grants to treat their sewage. Effluent from the new plant is well stabilized, and the Rio San Jose is slowly improving. This was one of our more serious problems and had it not been for Public Law 660 funds, these projects could never have been carried out.

Ruidoso is a beautiful little town in Lincoln County. It is primarily a summer tourist center. The winter-time population runs about 1200 permanent residents, but during the

(Continued on page 212)



Courtesy Walker Process Equipment Co.

● LAS CRUCES plant to relieve organic load on the Rio Grande included new lift station, interceptor, new digester and reconstruction of existing trickling filter.

How Collection Efficiency Influences Refuse Costs



● MILWAUKEE collection crew at work. Use of this 20-yard unit permitted men to stay on the job of collecting all day with only a single trip to the incinerator.

HAROLD J. ROW
Marketing Manager
The Heil Company

TOO OFTEN inferior performance equipment for refuse collection is purchased because proposals are evaluated on the basis of bid price alone, with little attention paid to relative performance characteristics of the different equipment models offered.

When tested on actual collection routes, under controlled conditions, a city will frequently find that one make or model will offer very great savings in collection costs as compared to others offered—savings resulting from greater amounts of refuse collected per day. Such potential savings are great enough to make it worth while for any buying city to set up a program to evaluate refuse collection bids on the basis of overall performance costs as developed in trial usage on actual routes in the city buying the units.

The basis of evaluation must be comparative performance analyses performed by city personnel for each type of equipment to be offered to the city. Much as they would like to present detailed performance data for such evaluations, manufacturers are unable to prepare such statistics on their equipment in a form which could confidently be presented to a prospective purchaser for comparative purposes.

In the collection of refuse there are so many variations in the conditions which may apply that performance figures collected under one set of conditions cannot be used with any high degree of confidence, unless, somewhere else these same exact conditions can be duplicated.

These duplicated conditions seem never to occur since cities all have different approaches, customs, or conditions which apply to these following factors: Wage rates; frequency of collection; make up of crews; distances to disposal sites; average weight of refuse per capita; average distance between pick-up points; type of refuse collected; types of container used; place from which refuse is collected (curb, alley, back of houses, etc.); terrain (flat or hilly); and, lastly, the type of refuse collection equipment used. All of these factors and the various combinations that can apply will affect performance.

Our job here is to isolate and point out how the selection of efficient equipment can lower the total collection cost as compared to the purchase of less efficient equipment. We must get this down to a basis where the collection is considered from the standpoint of "all other things being equal."

If a manufacturers' organization could agree on a set of standard conditions under which all equipment could be tested, and if these standard conditions would be such

that they might indicate predictable relative performance, theoretically we might be able to rate each refuse collection compactor in terms of a statistical percentage of performance in comparison to some known base.

This seems to be totally impractical, but to illustrate what I mean, let's assume that the base against which all other units would be compared would be an open truck body of 8 cu. yds. capacity. For our test standard load we might select some material of average compressibility, such as empty beer cans. For our test route we might assume that 55-gallon garbage cans are spotted on opposite sides of the road, 50 feet from the curb, in terrain having an average 10 percent grade; and that the truck is manned by two 35-year old refuse collectors in good physical condition, the truck being driven by a third man with similar characteristics; and so on to spell out a complete set of laboratory conditions. Theoretically, we might arrive at a standard capability for each make, model, and cubic yard capacity unit for these theoretical laboratory conditions.

From a practical standpoint, however, the first time someone tried to use these theoretical ratings as an actual comparison of equipment efficiency, it would be discovered immediately that the conditions under which the equipment was actually to be used would be quite different, and there would be no logical reason to assume that the theoretical ratings would predict relative performance of actual units under actual conditions. There are too many variables involved.

So what happens? All manufacturers of this equipment must content themselves with using comparative adjectives in their advertising and printed sales literature. The result is that one can thumb through the pages of any magazine serving this field and make the discovery that your English teachers apparently were wrong. There can be two or more superlatives. You won't have to look far to find four or five units each of which has the "greatest capacity" or "offers lowest cost refuse collection," etc.

In addition to giving advertising copywriters nightmares (each try-

ing to outdo the other in making his own advertising believable, yet making the same claims that all of his competitors make), this tends to make prospective purchasers rather blase about the whole thing.

The prospect, exposed to this high pressure and contradictory blast of sales ammunition reacts and says to himself, "Since these manufacturers don't seem to be able to offer any specific performance data to prove their statements, I guess they must all be pretty much alike."

This seems to be a logical conclusion, but as a matter of fact nothing could be further from the truth. If you have conducted any carefully controlled competitive demonstrations recently on your own routes, you know that when exposed to your particular set of circumstances, different units will turn in different amounts of work.

Under given conditions in a particular city, one unit may pick up 5 tons of refuse per day, while a competitive unit operating over identical routes might pick up 6 tons. What influence does this have on collection costs?

Hourly Costs

Let's assume some costs of unit operation which will be representative of the range of costs which most cities will encounter. You can easily fill in these blanks with costs as they would apply in your own city, of course, to bring the facts down to a local basis. Our assumed costs are shown in Table 1. Note that only about one-seventh of the total cost is involved in buying and depreciating the truck and body.

Having provided a unit to operate on a collection route at an overall cost of \$7.10 per hour, it remains to consider the effect of selecting equipment of different efficiencies. If one type of equipment can carry enough and be loaded fast enough to serve 1,000 residences per week, then service per residence will cost $40 \times \$7.10/1000$; or 28.4¢ per week. However, if a more efficient unit will hold enough more per load, and can be loaded swiftly enough to service 1,200 residences per week, then the cost per residence drops to 23.7¢, assuming the same operating costs per unit.

Total Costs

It seems logical to assume the same operating costs per unit, since we can also assume that the collection bodies would be mounted on an identical truck chassis. There might be some variables in fuel consumption and this factor should be

Table 1—Assumed Costs of Refuse Collection

Driver cost per hour	\$1.60
Two helpers @ \$1.50 per hour	3.00
Maintenance, fuel, lube, garage, etc.	1.50
Depreciation cost, five years, forty-hour weeks	1.00
Total cost per hour of collecting	\$7.10

Table 2—Cost of Operation

	\$10,000 Unit	\$12,500 Unit
Driver	\$1.60	\$1.60
Two helpers	3.00	3.00
Maintenance, fuel, etc.	1.50	1.50
Depreciation	1.00	1.25
Total hourly cost	\$7.10	\$7.35
Assumed residences served per wk.	1,000	1,200
Cost per residence served	28.4¢	24.5¢

checked out on demonstration as inefficiency in this respect might cost considerably more over the life of the unit.

Now, let's see what happens to the overall cost of refuse collection, if the more efficient unit which collects 20 percent more per day or per week costs more. Assuming the initial cost is 25 percent higher, we get the results shown in Table 2. The cost of collection per residence, if 1,000 are served per week is $40 \times \$7.10/1000$ or 28.4¢; and if 1200 are served per week by the higher priced unit, the corresponding cost is $40 \times \$7.35/1000$ or 24.5¢.

Rarely, of course, does one unit cost as much as 25 percent more than another one which is proposed on the same specifications, but in our example above even this wide discrepancy in first cost would be well worth while to achieve the greater route coverage which the more efficient unit offers.

No city purposely buys equipment which is not the most efficient possible. Many times, the new equipment is so much more effective than the older units the city is used to that, obviously, a great improvement in collection has been made, even though perhaps an even better addition could have been possible.

If I were sitting on a purchasing board, considering proposals to furnish various models of refuse collection units, unless specific operating data were presented to me, I

would feel I had no choice but to buy the lowest bid. The point that I believe in making, however, is that purchasers should make a greater effort to determine the relative capability of this type of equipment, and interpret these figures in a businesslike way to arrive at an overall operating cost, whether on a per ton or other basis of evaluation.

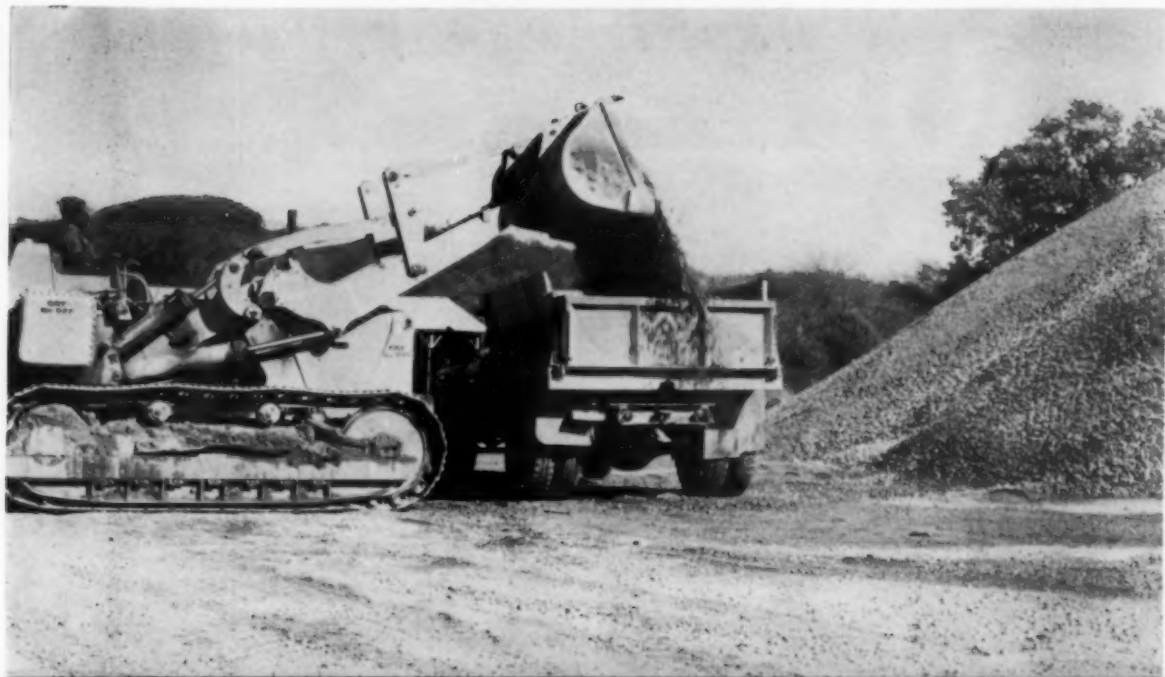
Published Cost Studies

There have been a number of very fine studies of refuse collection practices, costs, etc., particularly the one published by the American Public Works Association. In an effort to be impartial, however, these studies have been confined, insofar as costs are concerned, pretty much to the accumulation of facts as far as the actual experience of individual communities is concerned. These studies are very useful, since they give the operating personnel a chance to check their own cost experiences against those of similar communities offering similar service with similar equipment. It is a fine thing to be impartial. It is good business management and practice to buy equipment and materials which meet properly prepared specifications. But it is my belief, that the purchase of functional equipment such as refuse collection truck bodies more properly requires a detailed evaluation of overall cost, including depreciated first cost, rather than bid price alone.

When more and more communities do a thorough job of evaluating performance of these types of units it will serve to lower future collection costs by intensifying the competition among manufacturers for actual on-the-route performance of their new equipment models.

So long as it is difficult to convince buyers that all 16-cubic yard units are not the same, there is less incentive for equipment designers to strive for the greatest possible operating efficiency and the lowest possible operating costs. Obviously some manufacturers have striven with the utmost energy in this direction, or buyers would not be confronted with the choice of improved units now on the market. Municipal buyers should do everything possible to prevent manufacturers being tempted to say to themselves in the future: "So long as it meets most specifications, and has a low bid price, who cares about how much refuse it will pick up?"

We all care, really. The total national cost of refuse collection is a big one. We should all do our buying as though we do care.



Front End Loader Speeds County Highway Operations

WHEN Roy Ables took office as road commissioner of Lincoln County, Tenn., two years ago, he reached a decision based on economic necessity. He purchased a track-type front-end loader instead of a power shovel for a new quarry operation. He had convinced the county court that the 1,400-mile road maintenance program could be carried out more efficiently if it produced its own crushed rock rather than relying on river run gravel as in the past. Not only would a quarry provide select material, but it would permit year-around road work. The court had allotted him \$125,000. The question was: What equipment to buy with it?

The county's immediate need, simply to carry out day-to-day road maintenance, was for two new motor graders. After studying equipment used by successful contractors in the area, he ordered two new Caterpillar No. 12 Motor Graders.

The balance of the money, however, would have to be used in setting up the quarry operation. After purchasing a Pioneer crushing plant with 24 x 36-inch jaw crusher and

Williams impactor, two used Euclid 10-ton rear dump trucks, a Gardner-Denver 315 cfm compressor and an Ingersoll-Rand 3¼-in. wagon drill, funds had dwindled to less than the cost of a 1-yard power shovel. It was decided to use a Caterpillar Traxcavator, which cost about half as much as the shovel. Before buying it, however, a unit was put to work on a 30-day trial basis. At the end of that period Mr. Ables and Grady Wright, his quarry foreman, were convinced the machine would do the job.

Equipped with a heavy-duty 2¼-yard quarry bucket, the Traxcavator filled the dump trucks with four bucket loads in an average of three minutes and easily kept pace with the 1,200 tpd capacity of the crusher. In the past two years, the loader has handled more than 200,000 tons of shot limestone on a part-time basis. The machine also loads the county's 15 highway trucks from a crushed rock stockpile. In this operation, the truck driver moves his vehicle a few feet out of the way between loading cycles, making it unnecessary for the Traxcavator to pivot

between the truck and stockpile. With over 3,600 hours of use, wear on the shoes has been negligible.

In addition, the Traxcavator has been put to work on a variety of other tasks outside the quarry. For example, it has been used to clear a total of 10 miles of brush and trees, some of them up to 2½ feet in diameter. As an excavating tool it has moved nearly 50,000 yards of earth, either loading it into trucks or dozing it aside. It also has stripped topsoil and overburden, rough-graded roads, cut ditches and helped set up the crusher plant when it was delivered, lifting motors, screens, chutes and other components into place.

The county has not regretted going to a quarry operation. Centrally located, just outside of Fayetteville, the 3-acre quarry has provided a steady supply of crushed rock. As a result the road department has not only been able to surface three times as many secondary and rural roads as before, but has had enough left to cover parking lots, driveways and similar areas at county schools and on other county property.

Treatment Plant Has Long, Useful Life

ARTHUR T. BROKAW

Engineer and Director of Public Works,
Borough of Princeton, N. J.

and

STEVE M. SLABY

Associate Professor,
School of Engineering,
Princeton University

A PROPERLY designed and operated sewage treatment plant will provide service to a community for a considerable number of years. For this reason equipment and materials of proven quality should be used in its construction and it should be so designed that future expansions or additions may be installed as required by increased population or higher standards of treatment. The sewage treatment plant at Princeton, New Jersey, is presented as a good example of many of these desirable characteristics.

The original treatment plant, built about 30 years ago, was designed for a population of 18,000 and a

daily sewage flow of two million gallons. It consisted of one primary and one secondary sedimentation tank (with hopper bottoms), a one-acre standard rate trickling filter, unheated sludge digestion tanks with no provision for gas collection, a main pumping station having a total pumping capacity of 7 mgd, a head house with sludge recirculating pumps, and two glass covered sludge drying beds.

The plant serves the Borough of Princeton, the Township of Princeton, and Princeton University. Geographically the Township of Princeton completely encircles the Borough of Princeton while the properties and campus of Princeton University straddle the Borough and the Township.

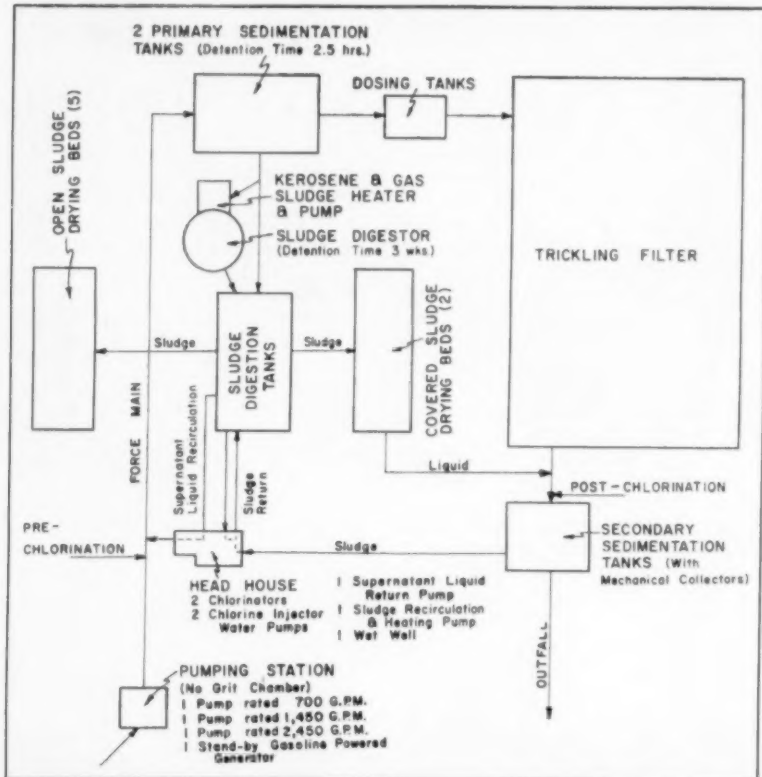
In the early 1930's these three parties agreed to construct a sewage treatment system which would service all of them. Administration of the entire sewerage system and treatment plant is handled by a Sewer Operating Committee which is composed of representatives of the partners. The Borough Engineer acts

as the secretary and sanitary engineer of this Committee.

When the original capital investment of the entire system is completely amortized the individual interests of the three parties in the system will be apportioned according to their contribution. Operating costs are shared on the basis of water consumption figures supplied by the Princeton Water Company.

On the basis of today's standards established by the New Jersey State Health Department the existing plant (with minor modifications and additions) has a capacity of about three million gallons per day. This increase in the rated capacity is due to a greater knowledge of the processes involved in sewage treatment and their methods of application, which results in a liberalization of capacity requirements in certain treatment units.

It was not until 1954 that additions to the treatment plant were necessary and these additions were required only because of new standards set by the New Jersey State Health Department relative to secondary sedimentation rates, sludge digestion capacity and minimum areas of sludge drying beds. In that year a reinforced concrete secondary sedimentation tank (16 ft. x 51 ft. x 8 ft. deep) was constructed next to the original tank and connected in parallel to it, providing either joint or separate operation. At present the tanks are operated jointly except when they are cleaned. The new sedimentation tank is provided with mechanized sludge removal apparatus of the Link-Belt type. In addition a reinforced concrete circular sludge digestion tank (35 ft. I.D. x 20 ft. deep) with a floating cover was added. The new sludge digestion system uses the Pacific Flush Tank method and includes gas collection and a sludge heating system. At the same time a 120-ft. by 40-ft. open sludge drying bed was constructed. A new 3½ mgd pump was installed since the existing larger pump was rarely used in daily operation and had high power requirements when used during exceptional periods of flow. With new State Health Department regulations, the standby pumping capacity for sewage treatment plants was reduced, thereby making it possible for the replacement of the costly larger pump by one having a lower capacity and a lower power requirement.



● FLOW diagram of Princeton treatment plant which has been in service 30 years.

In 1956 three more open sludge drying beds (120 ft. x 40 ft.) were added to the Princeton plant to comply with State Health Department regulations and population increases.

Modernization of the sewage treatment plant has continued with the addition of two new Wallace & Tiernan chlorinators which were installed at the end of 1960 for pre- and post-chlorination. These chlorinators are of a direct feed V-notch type which eliminate the bell jar chlorine feed chamber and its sometimes troublesome continuous water seal.

In addition to the new type chlorinator, a Foxboro vacuum programmer was added to the pre-chlorination unit. This programmer permits the superintendent to prepare aluminum cams which are cut by him to supply the required chlorine feed to the influent in accordance to the chlorine demand as determined by his own past experience and laboratory analyses. The chlorine demand will normally be at its maximum during hot humid periods and whenever atmospheric conditions contribute to the spread of odors from the plant.

As a result of the superintendent's many years of experience in this location, he has been able to prepare six or seven cams to be used on a seasonal and temperature gradient basis. Figure 1 illustrates the cam before and after it is manually cut to the required chlorine demand curve.

The vacuum programmer is one step toward full automation of chlorine feed which would provide control through a constant chlorine residual analysis. Such units are in the development stage but at the present time, particularly in semi-isolated locations, this type of complete control is a refinement not required.

The present programmer takes advantage of the valuable experience of an operator who has spent thirty years at the plant and will permit the retention of such information for future use long after the operator may have retired.

Another advantage of this system is that the operator does not have to maintain a constant vigilance during the pre-chlorination period. The Wallace & Tiernan V-notch type chlorinator embodies many features which guarantee direct feed with complete safety provision in case of malfunction or damage to any part of the equipment.

The new secondary sedimentation tank has proven very satisfactory,



● THE AUTHORS: Mr. Brokaw and Professor Slaby inspect the control panel of the sludge heater which has been installed adjacent to the 35-ft. sludge digestion tank.



● PLANT Superintendent Harry A. Kahny is holding an uncut programmer alongside a cut cam mounted in the Foxboro vacuum programmer for control of prechlorination.

especially with the mechanized sludge collectors which have simplified the operation and cleaning of this type tank. The new sludge digestion tank has also been a marked improvement over the older unheated tanks since the sludge is digested faster and is of a higher quality than in the past.

It is anticipated that continued expansion, particularly in the Town-

ship, will require further examination of plant facilities. In addition, modern automatic equipment will be installed to simplify operations and reduce manpower requirements. This treatment plant is always open for public inspection and will be featured at the June 16th meeting of the New York-New Jersey Chapter of the APWA to be held in Princeton.

MIAMI STANDARDIZES ON GAR WOOD-BUCKEYE



GAR WOOD-BUCKEYE 315, owned by the city of Miami, cuts through coral rock for a six-inch water main. Note clean sides of ditch, precise placement of spoil pile.

MIAMI DITCHES SERVICE LINES WITH GAR WOOD-BUCKEYE 403

Ditching for service lines requires a highly maneuverable machine. Miami has found that the best machine for the job is the Buckeye 403.

This crawler-mounted, ladder-type ditcher operates well over all types of ground, digging a clean, straight-sided trench with square corners that require no hand forming. The 403's low ground bearing pressure—7.5 psi—won't damage lawns or walkways. A hinged crumber shoe folds back to allow digging up to foundation walls and for undercutting obstructions. The machine is transported easily and quickly on a tilt-bed trailer.



The Buckeye 403 is another example of Gar Wood's outstanding ditcher engineering—engineering to provide contractors and municipalities with specialized machines that dig far more ditch at far less cost.

City Finds Buckeyes Best for Solid Coral

Whether you call it coral rock, key-stone coral or Florida lime—it's hard—and it comprises 60% of the Miami terrain. Ditching through solid coral can wear out a set of rooter bits in a single day. This is *really* tough ditching, and to do it the city of Miami has gone exclusively Gar Wood-Buckeye.

Miami owns 10 Buckeyes. According to John Layton, Maintenance Foreman for the Miami Water Board, "Buckeyes are by far the best ditchers for cutting through solid coral. And they are the best *all-around* ditching machines we have ever used."

Another reason Buckeyes have proven superior in Miami is low maintenance. "Coral rock is plenty punishing," says Layton, "but it hasn't stopped our Buckeyes. They continually ditch at top-notch efficiency. And they require less maintenance than any other ditchers we've ever tried."

Buckeye ditchers are the most modern on the market. Every major engineering development in ditching for the past 68 years has been found first on Buckeye ditchers. Today Gar Wood continues to set standards in the field—giving contractors and municipalities across the country high production, low maintenance, and long, trouble-free operation.

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NEWS BULLETINS

AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

APWA Presents \$5000 Check For Production of Training Film

A check in the amount of \$5,000 was turned over recently by the American Public Works Association's Research Foundation to the City College, of New York for the preparation and production of a 20-minute training film in color on the operation of motor pickup sweepers.

The film will stress three major aspects: proper operation and adjustment of the pick-up brush, proper operation and adjustment of the gutter broom, and safe operation of the machine. The target date set for completing the film is May 30, 1962.

Deputy Mayor Paul R. Screvane, New York City, who made the presentation, is Director of Region 2 of the American Public Works Association and is chairman of the APWA's Street Sanitation Committee which suggested the film.

The check presentation ceremony took place in Screvane's office in City Hall, and was attended by Professor William Finkel, chairman of the Department of Speech (associated with the Film Institute at The City College); Professor Yael Woll, director, Film Institute of City College; Commissioner Frank J. Lucia, Department of Sanitation, New York City, and Dr. Buell G. Gallagher, President of City College.

Funds for the film were raised by a broom fibre industry committee under the chairmanship of J.H.



New York City's Deputy Mayor Paul R. Screvane presents the Research Foundation's check for \$5,000 to Dr. Buell Gallagher as Sanitation Commissioner Frank Lucia looks on.

Rodgers of the O-Cedar Division of the American Marietta Company and turned over to the Research Foundation. Other contributing firms include DuPont, E.A. & B.C. Whiting Company, and the Newark Brush Company. Major American sweeping machine manufacturers, which are also sustaining members of the APWA, are cooperating.

Professor Logan Addresses In-Service Training Graduates

Chicago, Ill. — The In-Service Training Course for public works construction inspectors sponsored by the Chicago Chapter of the APWA came to a close April 26th with a

special luncheon at Chicago's newly constructed convention hall, McCormick Place. One hundred and nineteen out of 127 students completed all of the requirements of the course and came forward to receive special certificates at the graduation luncheon.

Special guests included: George L. DeMent, commissioner of public works, Chicago; James W. Jardine, Commissioner of Water and Sewers, Chicago; Frederick W. Crane, APWA President, Dr. John Logan, chairman, Department of Civil Engineering, Northwestern Technological Institute; and Robert D. Bugher, Association's executive director. The twelve-week course met weekly for three-hour sessions at the Technological Institute of Northwestern University.

Dr. Logan, featured speaker, told the group, "I am convinced, after a study of the magnitude and extent of today's problems, that they present a challenge to the public works profession which is as significant and as exciting as that facing any other profession, including the space scientists, the rocket experts and the medical groups."

Dr. Logan went on to say that many others did not share his view as was reflected in the low enrollment in civil engineering departments in the United States Colleges and Universities. "We are not now attracting either the number or the quality of young engineers needed to replace annual losses, let alone take care of the increasing needs of

OFFICERS: Frederick W. Crane, Buffalo, N. Y., President; Albert G. Wyler, New Orleans, La., Vice President. REGIONAL DIRECTORS: (term ending 1961) Louis H. Moehr, Wyandotte, Mich.; John A. Morin, Oakland, Calif.; Roy W. Morse, Seattle, Wash.; (term ending 1962) Paul R. Screvane, New York, N. Y.; Manon P. Phillips, Augusta, Ga.; Edward J. Booth, Bismarck, N. D.; (term ending 1963) George J. Maher, Lewiston, Maine; Robert S. Hopson, Richmond, Va.; Harlan H. Hester, Fort Worth, Texas. Immediate Past President, Jean L. Vincenz, San Diego, California. Robert D. Bugher, Executive Director.

a growing population," he said. A number of universities are giving serious consideration to the elimination of civil engineering from their curriculum, he remarked.

Logan said that part of the difficulty is undoubtedly lack of prestige, that civil engineering no longer ranks near the top of the professions as it once did, and that civil engineers are now definitely below the chemists, physicists, bankers, doctors and most other branches of engineering. He suggested that this might be partly due to a lack of interest in research on the part of persons in the profession.

"Regardless of the reason," he said, "the present crisis should be a matter of grave concern, not only to the profession but to the nation. Public works departments are, more than any other group, responsible for the effective and efficient operation of our metropolitan areas, and anything which adversely affects the profession seriously affects the viability and efficiency of the United States."

Dr. Logan added a note of encouragement by saying that responsible people are aware of the problems and that steps are being taken to initiate a new approach to civil

engineering education and ultimately to the conduct of the profession. He suggested a redefinition of what is referred to as civil engineering, more research, and more planning.

"In a survey conducted by a staff member in industrial engineering," Logan said, "in trying to determine why high school seniors choose one field over another, it was found that civil engineers had, by a considerable margin, the highest quotient of what was called 'citizenship', an interest in people and in the community. We have been finding that this interest can be used to attract an entirely new group from the high schools, students who were not previously thinking of civil engineering as a career.

"Perhaps we should try to find a more scientific description of our work and interests, although the terms 'environmental control' and 'environmental engineering' have been growing in popularity, perhaps a more exact title would be 'biospherics', based on the control and modification of the biosphere, the thin layer of soil, water and air that makes our planet habitable.

"Whether you like the term or not I am sure you will agree, that the work of our profession not only in

the United States, but throughout the world, offers one of the most exciting and challenging fields which a young man could enter, and we have been doing ourselves and the world a disservice in not making this fact abundantly known.

Bodien Names Committee Chairman For Association's 1961 Congress

Gordon E. Bodien, city engineer, Minneapolis, and general chairman of the 1961 Public Works Congress and Equipment Show, has named Hugo Erickson, coordinator, City of Minneapolis; and Milt Rosen, commissioner of Public Works, St. Paul, as co-chairman of the Management Committee for the meeting to be held in Minneapolis, September 24-27.

Other chairmen and vice-chairmen named to serve on local committees include: **Housing and Hotel Arrangements** — Ralph H. Sprungman, traffic engineer, City Engineer's Department (chairman); **Finance** — Einar S. Olson, utility auditor Coordinator's Office (chairman), and Glenn A. Bursell, administrative assistant, Finance, Engineer's Dept., (vice-chairman); **Transportation** —

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By Robert F. Baker

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Edwin L. Heath, superintendent of communications, Fire Department, (chairman); **Reception**—Helge G. Olson, superintendent of Buildings and Grounds, City Engineer's Department (chairman); **Inspection Trips**—Howard I. Moore, superintendent of parks, Minneapolis Park Board, and Eugene Avery, city engineer of St. Paul (co-chairman); **Exhibits**—Robert G. Bruce, engineering analyst, Coordinator's Office and Thomas A. Thompson, operations engineer, City Engineer's Dept. (co-chairmen); **Entertainment**—Leonard A. Johnson, city clerk, Minneapolis (chairman); **Publicity**—William W. Lundell, director of public relations, Minneapolis-Moline Co., (chairman); and Walter B. Dahlberg, public relations director, Minneapolis Park Board (vice-chairman); **Ladies Program**—Mrs. Harmon Ogdahl.

World Conference of Local Governments

A world conference of Local Governments will be held in Washington, D.C., June 15 to 20, 1961, on the joint invitation of the International Union of Local Authorities, the City of Washington, and the American associations affiliated with IULA including the American Public Works Association. The conference is being sponsored by the IULA with headquarters in The Hague.

The theme for this world conference will be "Recent Trends and Developments in Local Government." The main subject for discussion will be the structure and organization of local government. More than 400 local government officials from Europe, Asia, Africa and South America are expected to attend. IULA is a world-wide organization with members in 32 countries and contacts in another 15, dispersed over the whole of the free world.

The directors of certain organizations such as the APWA, the American Municipal Association, International City Managers Association, etc., compose the Committee on International Municipal Cooperation, U.S.A., through which local governments as well as national organizations participate not only in the affairs of the International Union of Local Authorities, but also in the Inter-American Municipal Organization which operates only in the American continents.

For further information on the Conference, as well as registration cards, contact Schuyler Lowe, executive director, Washington Secre-

tariat, World Conference of Local Governments, 1961, Room 526 District Building, Washington 4, D.C. Registration fee for U.S. members of IULA is \$30, for non-members \$35. The conference hotels will be the Statler-Hilton and the Mayflower; both will provide special rates for persons attending the meeting.

APWA Board Approves Petition for Mississippi Chapter

Chicago, Ill.—The American Public Works Association's Board of Directors recently gave approval to a request for the formation of a Mississippi chapter which would cover the entire State and coincide with its boundaries. The formation of the chapter was petitioned by APWA members within the State of Mississippi. The petition and chapter By-Laws were submitted to the Association's Directors for their review and approval.

A three-man committee has been appointed by President Frederick W. Crane to lay plans for an organizational meeting. The committee members are: John H. Teunisson, city engineer and director of public works, Greenville; E.M. Stiles, director of public works, city engineer, and building official, Natchez; and Frank Stewart, assistant city engineer, Jackson. Manon P. Phillips, commissioner of public works and city engineer, Augusta, Ga., APWA'S Regional Director for Region 4, will assist the committee in getting the chapter started. Officers will be elected at the organizational meeting.

The Mississippi chapter will become the Association's 35th chapter. Chapters of the American Public Works Association may be formed by members representing a region, state or locality for the purpose of furthering the objectives of the APWA in the proposed chapter's jurisdiction. Petitions must be signed by at least fifteen members, or applicants for membership, for the formation of a state or local chapter of the Association.

New England Chapter Plans a Clambake

The New England Chapter has planned an equipment show in conjunction with their annual meeting which is to be held on June 23 at the Pelig Francis Farm in Rehoboth, Mass. The annual dinner will be a clambake with all the trimmings. For details contact Chapter Secy. B. A. Clark, 2 Ernest St., Providence 5, R. I.

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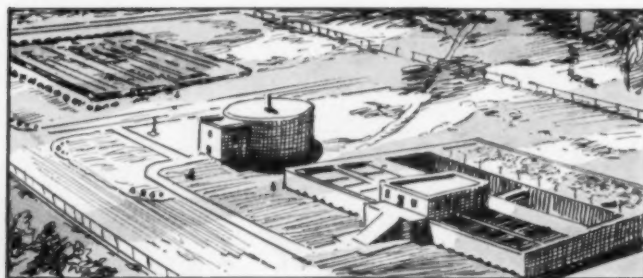
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THE SEWERAGE AND REFUSE DIGEST



Prepared by **ALVIN R. JACOBSON, Ph.D.**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Removal of ABS From Sewage

The precise significance of any particular amount of ABS in sewage or in waste treatment plant effluents is unknown. However, there are considerations of nuisance as well as increasing implications of environmental sanitation, which could lead to a demand for reduction in the ABS content of waste waters. Such a demand could result in either a prohibition of the discharge of ABS to sewers or a requirement that sewage treatment involves ABS removal. In view of these considerations, the authors, among others have conducted investigations under the sponsorship of industry and government, of possible methods of ABS removal. These studies show that existing sewage treatment processes are not generally adequate to meet greater needs for ABS removal than are presently imposed. Sedimentation removes but two or three percent; activated sludge may remove some 50 to 60 percent; while a lesser amount is removed by trickling filters. ABS can be reduced to one mg/L quite readily by a process called "surface stripping" which involves both induced frothing by aeration and froth disposal. The basis for an economical design of the first step has been established. Economical froth disposal, however, is a continuing goal of current research.

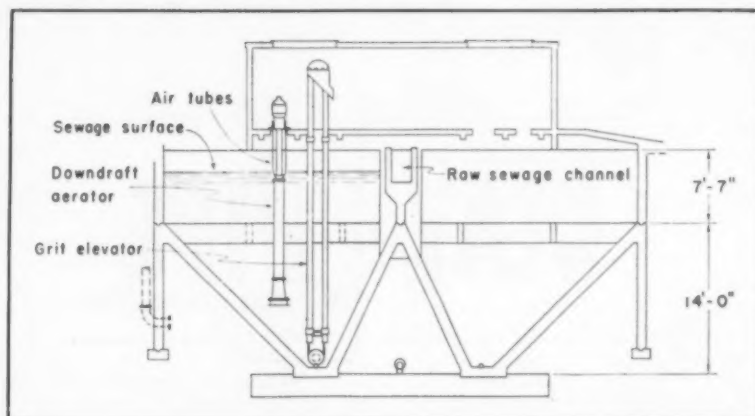
"The Removal of ABS from Sewage". By P. H. Gauhey and Stephen A. Klein, University of California, Berkeley, Calif. PUBLIC WORKS, May, 1961.

Preaeration Of Sewage

Preaeration is not a new idea in primary sewage treatment but it remains a misunderstood and controversial waste treatment process. In this investigation, the term "pre-

aeration" was restricted to an air agitation pretreatment of raw sewage for a period of 30 to 40 minutes prior to primary settling, without either the addition of chemicals or the return of final settling sludge, digester supernatant or any other material which might serve as a physical or biological aid to flocculation. The work was done in full-scale operation of the Ames, Iowa, municipal sewage treatment plant. Preaeration proved to be of consistent benefit to primary settling. As a result of this study, the following conclusions are cited: 1) Intensive plant studies indicated an average improvement of 7 to 8 percentage points in both primary BOD and suspended solids removals following preaeration. 2) The degree of improvement or benefit seemed not to be affected by a) the aeration method, b) the aeration rate, or c) the strength of the raw sewage. 3) The degree of improvement or benefit did show a correlation with the efficiency of plain settling. 4) The effect of preaeration on the early moments of settling appeared to be of prime importance. 5) In laboratory tests with 1-gal. samples under

ideal conditions, the combination of 30-min. preaeration and 1/2 hr. settling was found to outperform 2 or even 3 hour plain settling. 6) In brief plant-scale runs, the combination of 45-minute preaeration and 1-hour settling consistently outperformed 2-hour plain settling. 7) At the Ames plant, an aeration rate of about 0.1 cubic ft./gal. was found necessary to match the short-term oxygen demand and thus maintain a constant DO level in the preaeration tank during relatively stable afternoon conditions. 8) The preaeration process appeared to have no effect on the suspended solids content of the sewage passing through it, despite its influence on settling characteristics. 9) Because of its striking effect on the early moments of settling, preaeration could provide economical relief to seriously overloaded plants by restoring primary settling to normal efficiency. 10) The applicability of the preaeration process can best be judged on its merits for each specific waste treatment problem. Construction and operating costs are nearly the same whether or not preaeration is provided. Therefore, the



● SECTION through Ames' preaeration tanks. Preaeration was consistently helpful.

Courtesy Journal WPCF

Wichita

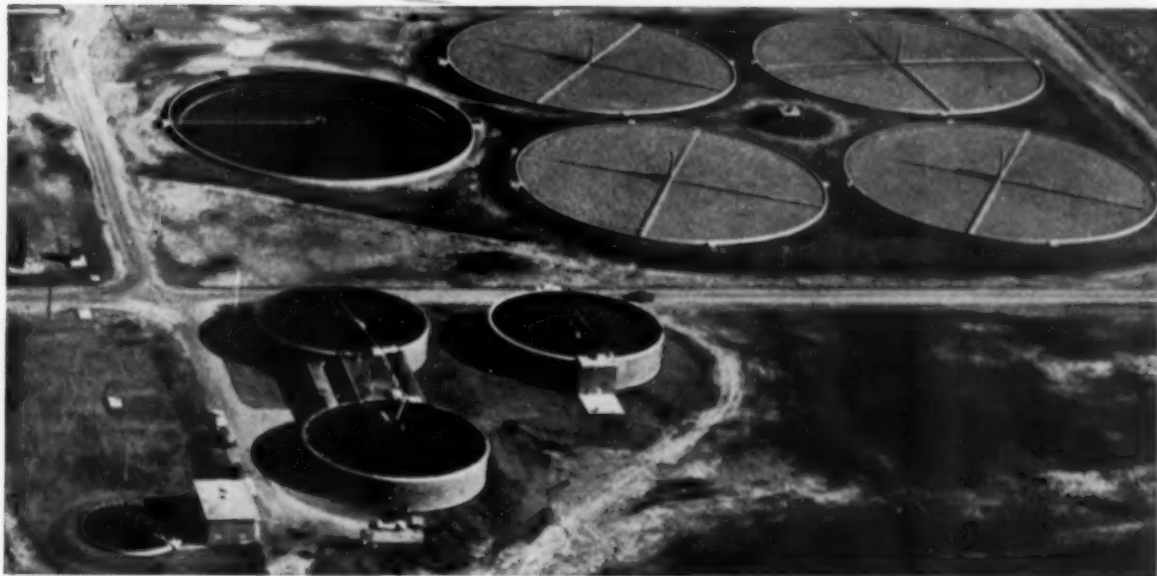
air capital of the world, specifies P.F.T.

Wichita, world's largest producer of private and business aircraft and manufacturer of the famous eight-jet, swept-wing Boeing B-52's of the Strategic Air Command, has specified modern, precision manufactured P.F.T. equipment for its sewage treatment plant.



Underlying central Kansas are 1,000 square miles of water-saturated gravel beds, known as Equus Beds. This tremendous water source, forming, in effect, a subterranean lake, provides Wichita with 70 million gallons of water per day. As a part of its important pollution control program, this progressive city selected the following P.F.T. equipment.

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PUBLIC WORKS for June, 1961

engineer's judgment is particularly important with respect to such secondary considerations as grit, grease, and treatability.

"Effect of Preaeration on the Primary Treatment of Sewage". By Harris F. Seidel, Director of Water Sewage Treatment, Ames, Iowa and E. Robert Baumann, Professor of Civil (Sanitary) Engineering, Iowa State University, Ames, Iowa, *Journal WPCF*, April, 1961.

Biology of Stabilization Ponds

In order to make quantitative evaluations of presently employed

biological waste treatment processes and to improve upon design and operation, it would be beneficial to have a knowledge of the biological phenomena which occurs. The population of any environment is controlled by the physical, chemical, and biological factors in the environment. The important physical factors affecting the population of a stabilization pond are temperature, light, and specific gravity. Hydrostatic pressure is also of importance in determining distribution and activity in certain aquatic environments. The important chemical factors are the nutrition factors, the

pH effects, and the toxic effects. The important biological factors in an environment are the inter-relationship of species. In a stabilization pond primary heterotrophs feed directly on the organic material introduced with the waste. In addition there will be present secondary and tertiary heterotrophs which feed on the cells of the primary heterotrophs or on their organic waste products. The autotrophic organisms, mostly algae, in a stabilization pond produce oxygen by the photosynthetic process. The problem of the control of the biological factors is one of keeping a balance between the various groups of the biological population. The primary heterotrophs should be encouraged as much as possible while the secondary and tertiary heterotrophs and the autotrophs should be controlled so the benefits of their metabolic activities may be gained. As much mixing as is economically feasible should be employed for best results. Each of these factors is discussed in considerable detail in this comprehensive article.

"Basic Biology of Stabilization Ponds". By Wesley D. Pipes, Jr., Asst. Prof. of Civil Engineering, Northwestern Technological Institute, Evanston, Illinois. *Water & Sewage Works*, April, 1961.

Salt Toxicity In Digestion

The volatile acids analysis has been used successfully in the past to determine abnormal or unbalanced conditions in the anaerobic digestion process. A rapid increase in volatile acids indicates the methane-producing organisms are not keeping pace with the volatile acids production. The test, however, does not furnish the reason for the unbalance which must be known for the proper application of corrective measures. Previous investigations have shown from the effect of various sodium salts on acetate fermentation that the decreased activity of the methane-producing organisms was due to "salt" toxicity instead of "volatile acid" activity. Thus, a rapid buildup of volatile acids and subsequent neutralization with alkaline materials is similar to a slug loading of volatile acid salts, and the detrimental effect observed is identical to that obtained when adding equivalent amounts of other common salts. The present investigation was made to determine the effect of high volatile acid concentrations on the methane-forming bacteria so that the application of the knowledge gained will aid in



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How sewage pumping is made easier with an Ampli-Speed magnetic drive

by Warren J. Birgel

Electrical Engineer
Electric Machinery Mfg. Company

For years a common method of varying the speed of sewage pumps to match flow rate was by use of wound-rotor induction motors. In recent times, however, a new electrical device has won wide acceptance for its efficient speed control capabilities. This device is the eddy-current slip coupling, or magnetic drive.



W. J. Birgel

With a magnetic drive installed between a constant-speed motor and the pump, pumping speed is adjusted with a simple potentiometer control.

The constant speed electric motor-magnetic drive combination provides an all-electric system that offers distinct advantages in planning new pumping installations or in redesigning older ones. Here's how:

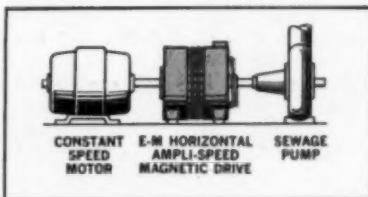
Smaller Wet Well. With a magnetic drive on one or more pumps, the wet well or grit chamber can be made 25-35% smaller because it must handle only average flow, rather than maximum flow. With constant-speed drivers, the wet well must be designed for maximum flow.

Improved Plant Performance. With adjustable speed pumping, sewage feed through the plant is more even . . . the surging associated with

constant-speed pumping is eliminated. In some cases, this makes it possible to avoid kilowatt demand penalties.

Less Pump Wear. With constant-speed pumps, the sudden-start surging of sand and gravel into the pump can often damage the impeller and casing rings. With a suitable automatic control system and magnetic drive, grit does not settle out because pumping is continuous. Abrasives move into the pump in suspension, with far less chance of pump damage.

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HORIZONTAL INSTALLATION is compact. And air-cooled Ampli-Speed requires no complex cooling system, may be installed and treated like a motor. E-M builds Ampli-Speed Drives to fit all pumping applications.

Ampli-Speed Gives You Precise Adjustable-Speed Pumping

E-M specialists, through extensive research into sewage pumping requirements, have developed a highly efficient, precisely engineered magnetic drive called Ampli-Speed. Check these Ampli-Speed features:

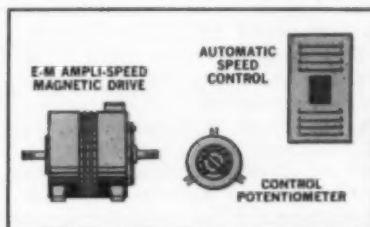
Simple Control. For manual control, operator adjusts potentiometer knob. Quickly adapts to automatic liquid level control systems.

Precise, Stepless Speed. Output speed held to close tolerances. Provides smooth, stepless speed changes.

Compact Installation. Ampli-Speed requires no more floor space than that required by drive motor on vertical installation, very little more on horizontal installation.

Air-Cooled. Can be installed and serviced like an air-cooled motor.

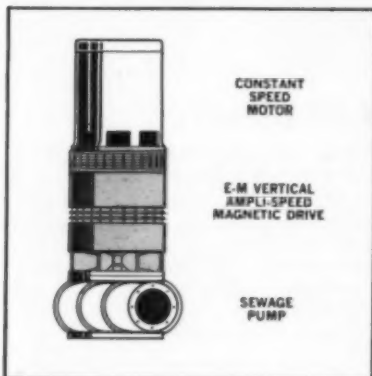
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Ampli-Speed is available for either vertical or horizontal installations, with wide range of input speeds. And E-M has designed applications through 800 hp.

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the control of anaerobic digestion and in determining the cause and effect of high volatile acid concentrations. The effect of various salts on acetate-utilizing methane bacteria was studied by adding the salt on a slug basis to a series of ¼ liter digesters containing active acetate-fermenting bacteria. The effect of the various salts was evaluated from the rate of acetate utilization as determined by gas production and analysis. The cations studied in order of increasing toxicity to the methane-producing organisms based on equivalent concentrations are: a) calcium; b) magnesium; c) sodium; d) potassium; and e) ammonium. These cations are much more toxic if added on a slug-basis than when added slowly over a period of time. Volatile acid concentrations up to 10,000 mg/L can be successfully neutralized with no inhibiting effects with the use of calcium or magnesium-hydroxide, but not sodium, potassium, or ammonium-hydroxide. Lime is an excellent material for neutralization of volatile acids because of its low toxicity and its ability to precipitate from solution as the volatile acids are fermented. The toxicity due to a slug-loading of up to 3,500 mg/L of sodium ions can be elim-

inated by the addition of 500 to 1,000 mg/L of either calcium or magnesium ions which act as cation "antagonists". Ammonium ion toxicity appears similar in nature to the toxicity of other ions at low pH, but appears related to the concentration of free ammonia in solution at high pH.

"Salt Toxicity In Anaerobic Digestion". By Perry L. McCarty, Asst. Prof. of San. Engineering, MIT, Cambridge, Mass. and Ross E. McKinney, presently Prof. of San. Engineering, University of Kansas, Lawrence, Kansas. *Journal WPCF*, April, 1961.

Revised Collection Routes

In 1958 the people of Franklin Township, N.J., located near the city of New Brunswick, adopted a council-manager form of local government which became effective on July 1, 1959. One of the first problems that the council directed the manager to study was a more efficient and economical system of refuse disposal. A Rutgers University student majoring in political science and city planning was hired to make a field study of present collection operations. Armed with stop watch, maps, counters, etc., he

followed the collection crew in a complete round of collections while at the same time charting the route followed, the pick ups, the stops, the time intervals and general operational effectiveness. From the study a number of recommendations developed as follows: 1) a larger capacity truck should be obtained to permit a reduction in the number of trips to the dump from 3 to 2 per day, and, consequently, to increase the time available for collections. 2) Route splintering must be eliminated and contiguous, fairly compact, route districts set up. 3) A key to the fenced-in dump area should be left with the driver of the garbage truck to take care of late arrivals. 4) Regulations governing the type of garbage accepted and the manner in which it should be set out, should be drawn up and distributed to all householders. 5) A general schedule should be established so that the administration will know approximately where the truck should be at a particular time, and so that the crew will know what is expected of them. 6) All new housing in the service area should be recorded on the map and provided for in the routing, and regular restudies should be made to see if the efficiency of the route is being maintained and



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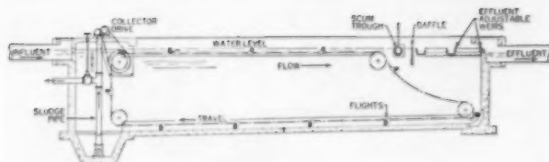
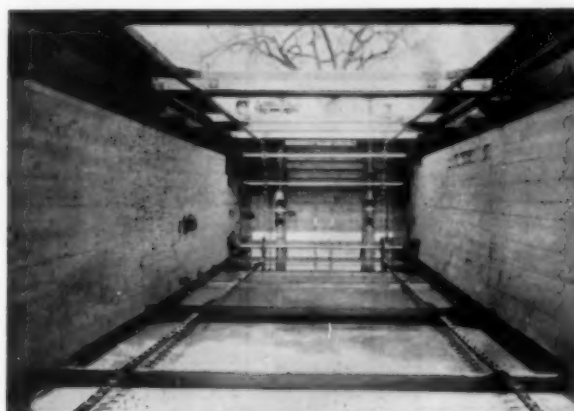
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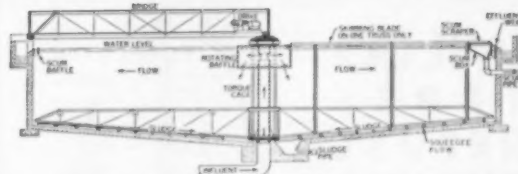
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Send for Circuline Sludge
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to prevent quality of service from dropping. The objectives of the study and rerouting of the collection routes has been achieved resulting in efficient and reliable collection service for the 20,000 people of Franklin Township.

"Revised Collection Routes Meet Suburban Growth." By William A. Sommers, Township Manager, Franklin Township, New Jersey. PUBLIC WORKS, May, 1961.

Other Articles

"Sewer Maintenance Crew Specializes in Safety." Getting sewer maintenance men to use available safety equipment is very important. By A. J. Muir. PUBLIC WORKS, May, 1961.

"Sealing Sewers By External Grouting of Joints." The City of Hollywood, Florida, prevents high rate of infiltration by the external application of cement grouting to the sewer lines. By Fred D. Dahlmeyer, Engineering Inspector, City of Hollywood, Florida. PUBLIC WORKS, May, 1961.

"Monitoring the Lower Mississippi." New warning network alerts municipal water users of accidental river pollution. By John E. Trygg, Director, Division of Public Health Engineering, Louisiana State Department of Health. PUBLIC WORKS, May, 1961.

"Volatile Acids By Direct Titration." A rapid and reasonably accurate method of determining volatile acids in raw and digesting sludges. By Rosemarie Di Lallo, Chemist, New Rochelle Sewage Treatment Plant, New Rochelle, N. Y. and Orris E. Albertson, Development Engineer, Dorr-Oliver, Inc., Stamford, Conn. Journal WPCF, April.

"Theory and Practice of Activated Sludge Process Modifications." A Review of recent developments as they apply to several modifications of the

activated sludge process and a discussion of recent performance data from these processes. By W. W. Eckenfelder, Jr., School of Engineering, Manhattan College, New York, N. Y. Water & Sewage Works, April, 1961.

"Starting Up the Cross Creek Plant." How Fayetteville, N. C., solved its operating problems when its new 9 mgd plant went on line. By James E. Freeman, Superintendent of Plants, Fayetteville, N. C. Wastes Engineering, April, 1961.

Sanitary Landfill Operations

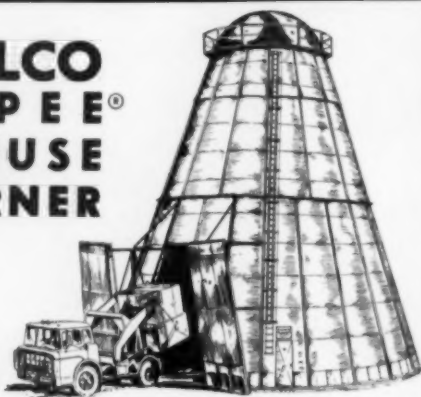
C. A. ARMSTRONG
City Engineer
Rochester, Minnesota

AN ABANDONED gravel pit covering approximately 15 acres is the site of a sanitary landfill operated by Rochester's engineering department. The land is leased from the owner without charge under an agreement that the City will use the land for a landfill and cover the top with approximately 2 feet of dirt taken from the spoil banks and the bottom of the old gravel pit. Rochester, Minnesota, 40,000 population,

covering 8.5 square miles, is the home of the Mayo Clinic with its attendant hospitals, hotels, and restaurants; an IBM plant which employs 2000 people; and the principal retail center in Southeastern Minnesota.

The principal piece of equipment used at the landfill is an Allis Chalmers HD 11-G tractor shovel (crawler tractor with 3 cu. yd. bucket). In addition, we also use a ½ cu. yd. Lorain dragline on crawler tracks, part time, and several dump trucks or a scraper in hauling dirt for the final covering.

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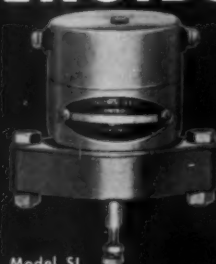
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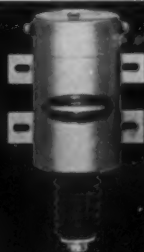
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CYCLES Not to exceed
6 per minute
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Model SL

MODEL SD

VOLTAGES (D.C. Only)
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40A. 20A. 15A. 4A.
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PULL... Approximately 10 lbs.
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E. A. Symonds, Needham Superintendent of Sewers, selected Evanite Plastic Sewer Main in 8-inch diameters, plus plastic fittings and 4-inch plastic house connections, after extensive tests established Evanite as impervious to attack by chemicals found in sewage and industrial wastes. It was also determined that Evanite's non-absorptive quality, as compared with existing sewer pipe materials, eliminates percolation through the walls, and has adequate crushing strength for sewer main service under city streets.

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Six months after installation, the Evanite system was checked for deformation and leakage. It was found to be free from infiltration, completely straight and round. Mr. Symonds concluded, "In our opinion, the solvent welded joint used with Evanite Plastic Sewer Pipe is the most fool-proof joint on the market today. Evanite Plastic Main has demonstrated in service all the advantages claimed for it, and we expect to use it again on future projects in the Town of Needham."

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Evanite comes in standard 10-foot lengths . . . longer lengths available . . . up to 15 inches in diameter. Because of its lightness (2.5 lbs. per foot in 8-inch diam.), it is easy to carry, easy to install and handle. Write for additional information.

*Bulletin No. UM-26, Architectural Standards Division.

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The dump is open to the public 24 hours a day, 7 days a week without charge. The tractor operator works from 8 A.M. to 6 P.M. Monday through Saturdays and occasionally on Sundays in the spring and fall when hauling is especially heavy. Because the site is an abandoned gravel pit, there is very little trenching to be done. We do excavate about 4 feet below the bottom of the pit and use this dirt for covering. The total fill runs from 12 to 15 feet in depth.

We dump from a face approximately 100 ft. wide, and run the ramp parallel with the dumping face. The tractor works almost continuously during the day, packing the refuse and covering it with dirt at the end of the day. The dragline is used to dig the dirt from the bottom of the pit and cast it up onto the top or into a stock pile for the front-end loader to spread.

Load counts taken at the dump in February 1960 ran from a minimum of 129 vehicles a day on a Thursday to a high of 529 vehicles on a Sunday, week-ends finding mostly householders hauling in their own automobiles. The amount of rubbish deposited at the dump averaged 3000 cu. yds a week, loose measure in the hauling vehicles. The operating budget for 1960 is as follows: Two operators' wages, \$11,000; utilities, telephone and garage costs, \$320; equipment operation and repairs, \$10,000; equipment depreciation, \$6,000; and total, \$27,320.

Winter Operations

Winter does not present a great problem because the cover material is sandy gravel and does not freeze solid. We stock pile a quantity of dry gravel before freeze-up and haul out of this stockpile during the winter. This dump takes all rubbish and garbage from the City and the suburban area. A brush and timber burning dump is maintained separately from the landfill dump. The two dumps are about a quarter of a mile apart. The same tractor shovel also does the necessary work at the burning dump. The greatest problem at the landfill dump is caused by people coming in late at night and setting fire to loose paper either by dumping hot ashes or through carelessness with matches or cigarettes.

The collection of rubbish and garbage is under the control of the Health Department of the City. Until last year the City forces hauled all the garbage, and commercial haulers handled all the other rubbish. Now, however, garbage may be

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Mike Microbe stars in a new Smith & Loveless movie which features the manufacture, operation and installation of an "Oxigest" sewage treatment plant.

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PUBLIC WORKS for June, 1961



The Hilton Inn across from New Orleans International Airport is served by two 20,000-gallon "Oxigest" units.



A Kansas City North subdivision is a good example of installations in parallel to serve a growing development.



Glen Oaks School in Baton Rouge, La., is a typical "Oxigest" installation to serve a school without sewers.



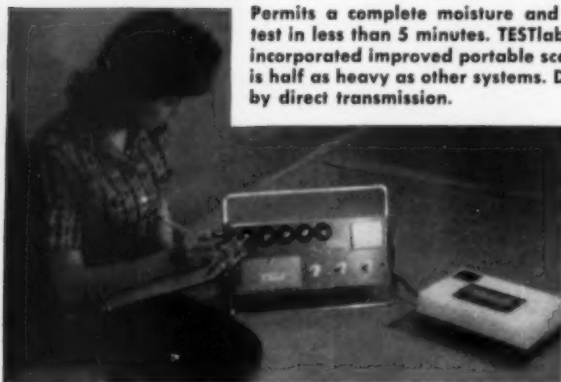
Camden, N. J., Latin Casino theatre and restaurant is provided sewage treatment by a large bolt-together "Oxigest."



A St. Joseph, Mo., mobile home park is served by a Smith & Loveless "Oxigest," with the new Alcoa aluminum fencing.

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wrapped and combined with other rubbish and hauled by any commercial hauler or the householder himself. The City is considering discontinuing any garbage or rubbish hauling and leaving it all to commercial haulers. At this time, the City forces haul all of the commercial garbage from the 72 hospitals, hotels, and restaurants as well as the combined garbage-rubbish from one-sixth (1600) of the homes in the City. Commercial haulers or the householders themselves haul combined garbage-rubbish from the rest of the residences.

City collection equipment consists of one Leach bucket-type loader for the commercial garbage, one Leach Packmaster and 2 covered dump trucks for the residential pickup. Commercial garbage is picked up either 3 or 6 times a week as requested. Residential garbage-rubbish is picked up twice a week. The charges for the City commercial garbage pickup are 50 cents for the first 32 gallon can, and 40 cents for each additional can. The charge for City residential household pickup is \$1.75 per month for one 32 gal. can and 25 cents for each extra can.

The commercial haulers pick up rubbish or combined garbage-rubbish from an estimated 40 percent of the stores and homes in the City. Their charges are equal to or slightly higher than the charges of the City forces. There are at present, 15 licensed commercial haulers using 6 Garwood, 5 Heil, and 3 Leach packers, plus 3 covered dump trucks. The commercial hauler license costs \$25 per year and is subject to inspection by the health department, but the City exercises no control over haulers' charges to their customers.

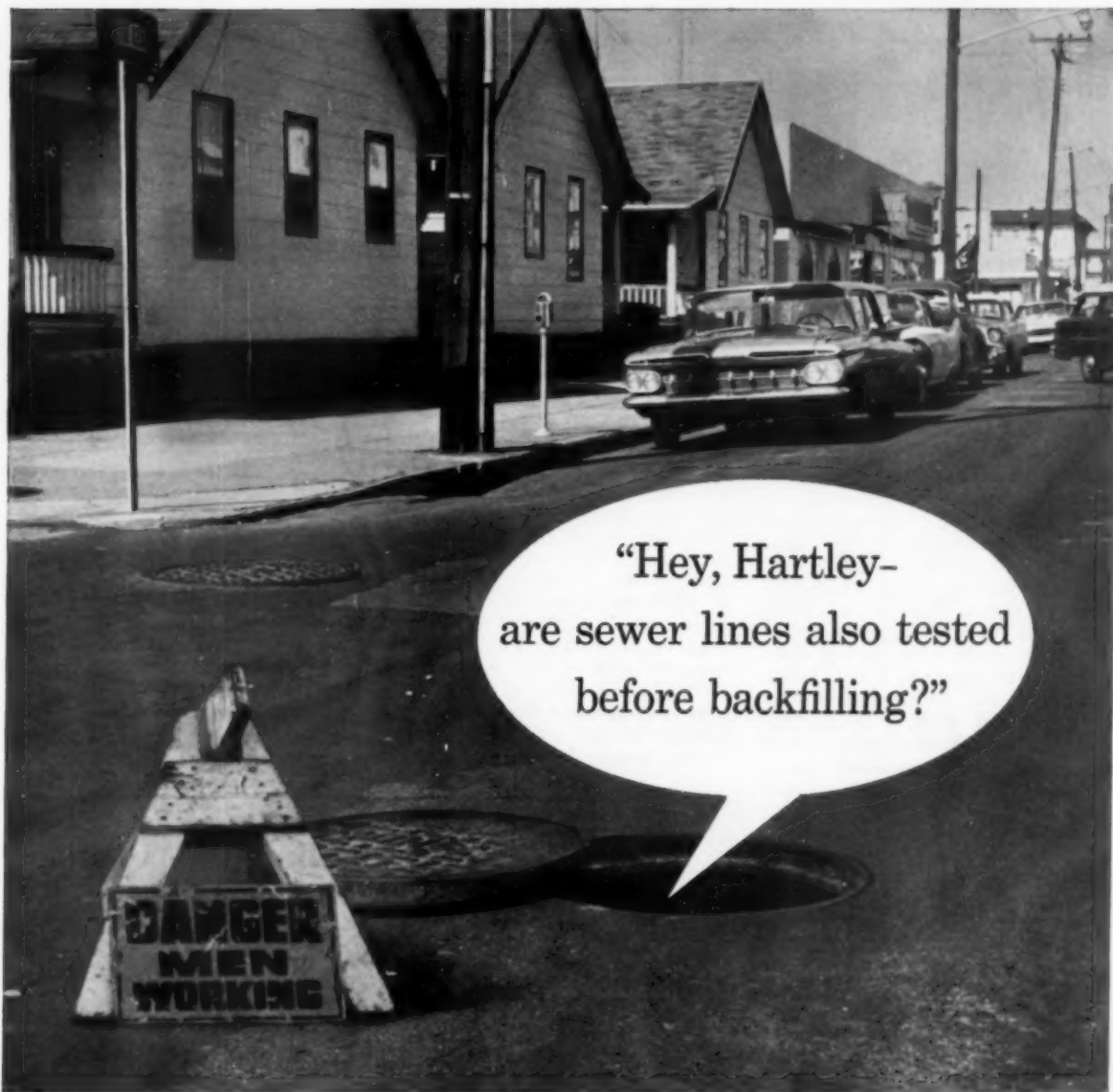
The estimated breakdown of service to the 9000 businesses and residences in the City is: 17 percent City service; 40 percent commercial haulers; 10-15 percent private incinerators and garbage grinders; and 20-33 percent hauling by householder.

• • •

Detroit Sewage Treatment Data

An average daily flow of sewage amounting to 619.4 mgd was treated at the Detroit, Mich. sewage treatment plant during the year ending June 30, 1960. A total of 102,807 tons of dry solids was removed by primary treatment; suspended solids were reduced from 217.7 to 110.9 ppm, or 49.1 percent. The tank effluent was chlorinated, using 3,278 tons of chlorine.

PUBLIC WORKS for June, 1961



Yes! More and more specifications are calling for leakage (exfiltration) tests. Therefore, contractors have to be prepared for them.

When a line has to be tested before backfilling, contractors will usually look to Transite®, the white sewer pipe. You see, many have found it economically unsound to challenge a leakage "spec" with any other joint than a Ring-Tite® one. And, no wonder! This exclusive Transite joint is precision-machined instead of molded.

There have been times, and all too frequently, when materials other than Transite have virtually ruined contractors' job costs because of the time it has taken to condition a non-Transite line to eventually pass a leakage test. Incidentally, Johns-Manville is so sure of their Ring-Tite Joint, they don't consider a specification of 100 gallons/inch diameter/mile/day a tough one to meet at all.

Johns-Manville's movie—"Pipelines To Health"—tells why a Transite line is a sound investment today and for the future. It's available along with facts and data to support their claim that "Transite is designed with sewer service in mind." Write to Johns-Manville, Box 14, PW-5, New York 16, N. Y. In Canada: Port Credit, Ont. Cable address: Johnmanvil.

JOHNS-MANVILLE
TRANSITE PIPE



Test water goes in ... stays in!



THE HIGHWAY AND AIRPORT DIGEST



Prepared by L. G. BYRD, Associate Editor

Hot Mixes With Lime

The use of hydrated lime as an additive in hot mixes using marginally acceptable aggregates has found wide application by the Colorado State Highway Department. The lime performs like a chemical additive rather than a void filler, increasing the strength and stability of asphalt mixes while making them more water resistant. Swell, water absorption and stripping have also been reduced. The lime tends to toughen the mix, permitting faster compaction and attainment of higher densities. Most hot mix aggregates in Colorado are contractor produced from local gravel sources. While some are suitable, many deposits yield aggregate containing small amounts of clay, particularly of the swelling type like bentonite. As a result, these aggregates are often slightly plastic, have an affinity for water, swell considerably and tend to strip. Asphalt pavements, constructed with such aggregates used without being upgraded by an additive, will have poor stability and lack durability. Improvements imparted by hydrated lime can be seen by results of laboratory tests. These include the Stabilometer, Cohesimeter and Immersion-Compression tests. The latter was developed by the Bureau of Public Roads and demonstrates lime's waterproofing and strength developing qualities.

"Colorado Upgrades Gravel Hot Mixes with Lime." By Bud A. Brakey, District Materials Engineer, Colorado Department of Highways. *Roads and Streets*, April, 1961.

Training Maintenance Crews

In street maintenance the effectiveness of the plan is no better than the ability of those persons responsible for getting it done. Unfortunately, the agencies of government

largely responsible for street and highway maintenance rarely find themselves in the position of being able to compete with private enterprise for trained and highly qualified personnel to fill positions on paving maintenance crews. If these agencies are to achieve a high rate of efficiency, they must enter into some sort of training or educational program for their personnel, to provide serviceable, safe and smooth streets for the motoring public. Most street maintenance organizations are participating in such training programs, frequently without officially

identifying them as such. In fact, the greater part of the training is "on the job," rather than costly classroom training. However, Oklahoma City has effectively stretched its street maintenance dollar with a small investment of "maintenance crew time" in formal training programs. Paving deterioration is divided into three groups: deep base failures, surface raveling and longitudinal shrinkage cracks. To cope with these problems the maintenance program is divided into preventive and curative parts. Preventive work includes skin patching,

New Stabilizing Mixer on Test



AN EXPERIMENTAL industrial soil blending machine has been developed by Howard Rotavator Co. of Harvard, Illinois. The unit, called "Unimix" is designed to work off the power take-off of industrial and agricultural tractors in the 55-80 B.H.P. class. It has a mixing width of 80 inches and can easily be adjusted to provide mixing

depths of from two to seven inches. A unique gearbox makes it possible for the operator to change rotor speeds in seconds while on the job. The machine is not a "beefed-up" agricultural rotary tiller but was specially designed to meet industrial soil mixing and blending needs of the small contractor, counties and municipalities.



Year-round work-horse

Community of 28,000 finds veteran Michigan handles "nearly every job that comes up"

A Story of Savings

By Robert F. Erwin

Manager

Falls Township

Bucks County, Pa.

Our Model 75A Michigan is not just another piece of equipment to be put to bed for the winter.

After the weather gets too cold for construction, this unit continues to work.

It is used in some way on nearly every job that comes up . . . giving us versatility, economy and good performance on all of them.

Our township includes most of Levittown, Fairless Hills, and U. S. Steel's Fairless Works. 27.4 square miles. 28,854 people. 7,152 homes. 70 miles of streets. A Public Works budget in 1961 of \$801,068.

Replaces crane, labor crew to clean muddy ditch

One of our toughest jobs—and perhaps the Michigan's most unusual

assignment—is cleaning a 4-mile-long drainage ditch. Previously we used hand labor and a rented crane. Now the Michigan Tractor Shovel drives right into the wet, muddy, often soft-bottomed ditch . . . mucks it out . . . then truck-loads the waste material.

Plows more snow than truck with 2-man crew

Another valuable Michigan assignment is snow plowing. Heavy snow particularly. Last winter we faced drifts higher than the Michigan cab (9½ feet!)—yet the 77 hp, four-wheel-drive machine *was never stopped!* Using a bucket-mounted V-plow, engineered by myself and the Township's mechanic, Sandor Arch, the Michigan and its one operator did more than any truck and its two operators.

Saves over \$10/hr ripping asphalt

We find other jobs for the Michigan all the time! A homemade 10 ft crane boom lets us lift loads up to 7,000 lbs. Its bucket action is used to break concrete roads—average depth of slab, 6 or 7 inches. Scarifier teeth, permanently mounted to the bucket, rip asphalt. (Savings here are substantial—the Michigan alone does what formerly

required a work crew of five men with air hammers, or several pieces of \$10-per-hour rented equipment.)

In 3 minutes, loads 10 tons

Naturally, the Michigan loads trucks too. It handles all kinds of material. Stockpiled gravel. Windrowed snow. Sand. Cinders. Dirt. We figure its 1¼ yd bucket heaps a typical 10 ton truck in 5 or 6 passes, 2 to 3 minutes.

In 3 years, only 2 hours downtime

We've had the Michigan three years now. We've worked it 24 hours a day during bad blizzards . . . 40 hours a week most other times . . . *year around.* In all this time, we've lost *only two hours* of assigned work. The Michigan has proven powerful, easy-to-handle, low-cost (a tank of gas, 30 gallons, easily lasts a day), fast, dependable, versatile—the best year-round machine we've ever seen!

Michigan is a registered trademark of
CLARK EQUIPMENT COMPANY
Construction Machinery Division

**CLARK
EQUIPMENT**

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Benton Harbor 24, Michigan
In Canada:
Canadian Clark, Ltd.
St. Thomas, Ontario

seal coating and crack filling. Oklahoma City has found a rather large crew of seven men offered the best size to establish effective routines. The crew make-up includes: a foreman-driver; a man to pre-clean patch area and place traffic warning devices; a workman to prepare the patch section by painting the edges of the cleaned area (and to apply heat in cold weather); a material handler who distributes the hot mix from the dump truck bed; two rakers to spread material and; a man to seal the patch edges with a hot iron and smooth the patch. With this crew organization, on the job training is carried on without noticeable delay in work progress. The essential rules to follow in a training program include: defining the problems; outlining the solutions; and stressing, to the crew, the importance of the work.

"Training an Efficient Paving Maintenance Crew." By W. W. Baker and Neal A. McCaleb. *Asphalt Institute Quarterly*, April, 1961.

Sign Maintenance Truck

Specially-built sign truck bodies, made in the Tyler District carpenter shop of the Texas Highway Department, have been installed on each

of the ten maintenance section sign trucks. Mounted on one-ton pickup trucks and averaging \$333 in cost, the bodies have removable compartments for hauling or storing wood and metal signs, tools, paint supplies, bolts, clamps and other needed items. Each body also has a ladder rack on top, a 30-gallon water tank and a removable bottom shelf for extra storage. Since their installation the trucks have proven their worth by enabling sign crews to keep adequate supplies of materials on hand as needed.

"Sign Maintenance Truck." *Texas Highways*, April, 1961.

Balanced Roadside Maintenance Program

The establishment of the Interstate system promised the addition of an estimated 900,000 acres of roadside to be maintained. The importance of the roadside as an integral and functional part of the complete highway makes the success of this facet of highway maintenance of interest to highway engineers and officials. Recognition of roadside areas as a valuable part of the natural resource of every adjoining community broadens the interest in this program to include community groups, officials and the

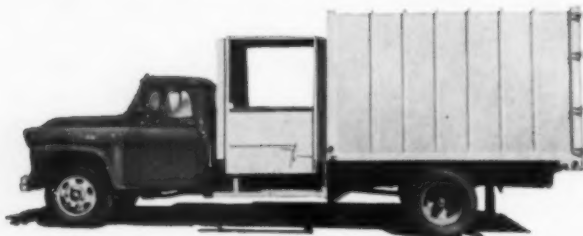
general public as well. Since the discovery of the growth-affecting properties of 2, 4-D in the early '40's and the subsequent development of other selective herbicides, these have become valuable cost-reducing tools of roadside maintenance. The Connecticut State Highway Dept. has demonstrated a savings of about \$10 for every \$1 expended on chemical herbicides. Herbicide programs, however, must be considered as only a part of an effective overall program which includes proper liming, fertilizing, reseeding and a sound mowing system.

"Connecticut Believes in a Sound Roadside Maintenance Program. . ." By E. F. Button, Agronomist, Connecticut State Highway Department. *Better Roads*, April, 1961.

Financing The Highway Program

Since the birth of federal aid to highways, the policy of the American Road Builders Association has been the advocacy of the balanced, long-range, soundly financed federal-state construction program needed by our country to meet the demands of an expanding economy. Only when the rate of construction is established and assured by firm

Two Low-Cost Ways to Get a Cleaner Community



RAM-PAK BAUGHMAN REFUSE TRUCK

The self-packing, self-unloading refuse body with many exclusive features:

Ram-Pak Refuse Truck has self-packing feature that permits more rubbish collecting before dumping is necessary. Load from both sides, has large crew ramps. Water tight body. Dumps automatically with powerful twin ram hoists. Two body sizes. Write for Leaf-Vac Bulletin A-457 . . . Ram-Pak Bulletin A-433-A.

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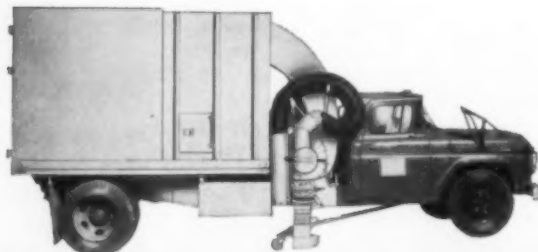
308 SHIPMAN ROAD • JERSEYVILLE, ILLINOIS

6099

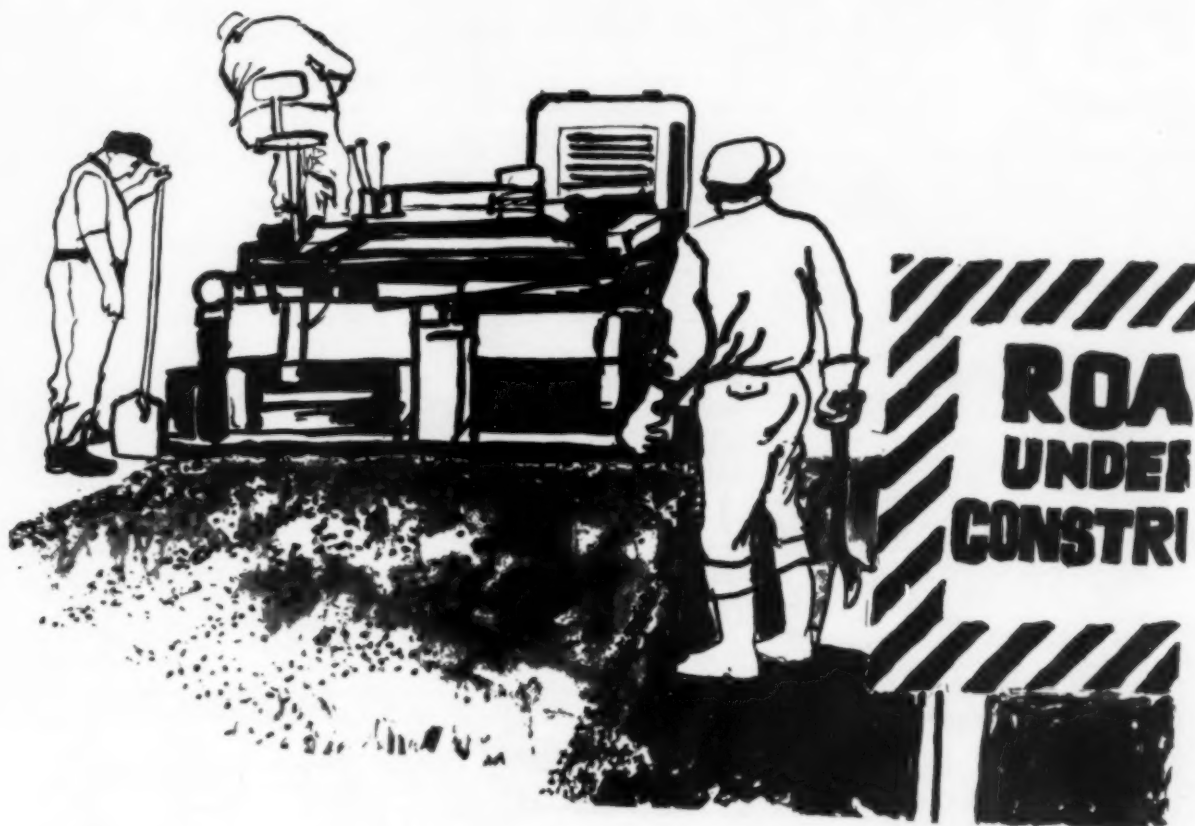
LEAF-VAC BAUGHMAN LEAF SWEEPER

The modern vacuum-action method for cleaning leaves from streets and gutters.

Leaf-Vac Leaf Sweeper does efficient leaf and twig collecting through powerful vacuum suction, has auxiliary engine to power blower. A 12-foot hose attachment cleans catchbasins and the curb-to-sidewalk area. Collects full 5-foot swath without raising dust; vapor spray keeps dust down while loading and unloading. Dumps automatically. Three body sizes.



FOUR STEPS to better secondary roads with COLUMBIA CALCIUM CHLORIDE



1. PREPARE. Make a master plan to cover future growth of your communities. Determine the eventual use of each road, and bring the roadway width, alignment and drainage to these standards.

2. SHAPE UP. Place the first course of stabilized aggregate wearing surface. Columbia Calcium Chloride provides dust control while helping to hold the fines moist and keeping the aggregate in place.

3. BUILD UP. As budget and traffic load permit, add the dense graded base which will provide the support needed for future traffic needs. Again Columbia Calcium Chloride contributes its moisture-holding and binding properties to a better driving surface, proper compaction, and protection against loss of fines or ravelling of top surface material.

4. FINISH UP. When you are ready to add hard paving, you'll find the aggregate base needs a minimum of reshaping or additions of material when Columbia Calcium Chloride has been used properly. The final job is superior, because of compaction and strength of the base.

By following this progressive plan, you can give more people better roads for more of the time, and still keep on budget. Residents appreciate knowing what improvements are coming, and they like the safer, more comfortable driving on dust-free aggregate roads treated with Columbia Calcium Chloride. Send for the booklet,

"A Program for Progressive Improvement of Secondary Roads." It gives all the details.



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Title _____ Organization _____

Address _____

City _____ Zone _____ State _____

financing can we have such a construction program. It is essential that the program be long-range to assure efficiency and economy. A knowledge of the rate at which federal funds will become available for the federal aid Interstate construction program will permit; 1) officials to prepare sound expenditure schedules; 2) proper coordination of right of way acquisition, engineering and construction; 3) economical segments of highways to be initiated and completed on schedule; 4) states to know in advance what matching funds will be required and; 5) industry to expand intelligently. The

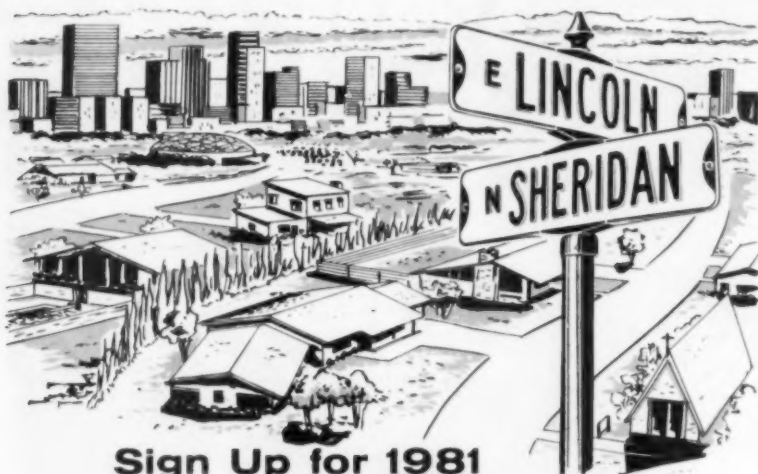
1956 Federal Aid Highway Act was a balanced long range program but it was not soundly financed. During the next 11 years, the President's program anticipates federal expenditures from the Highway Trust Fund totaling \$41.5 billion. Under existing law anticipated revenues coming into the Fund are \$31.8 billion—\$9.7 billion short of the needs. If the \$2.5 billion of anticipated revenue from automotive excise taxes earmarked for the Trust Fund is channeled back into the General Fund of the Treasury as the President has proposed, the Trust Fund deficiency will be \$12.2 billion. That is the problem

facing the Congress. The findings of the Highway Cost Allocation Study support the view that heavy trucks should bear the responsibility for a larger share of the federal highway tax burden. The President's alternative proposal to increase the federal gasoline tax to 4½¢ also appears acceptable. At the present time only 12¢ of the motorist's transportation dollar is allocated to paying for highways while the average motorist is paying the equivalent of a 20¢ per gallon tax in accident costs. The new 1961 Interstate Cost Estimate will become the basis for apportionment of Interstate funds in the coming years. This estimate is based on average low bid prices in 1959. Unit prices, which have steadily decreased since 1957, are now lower than in any year since 1955 because of improved technology and intense competition. With the inevitable increase in right of way costs in the future, highways are a better bargain at the present time than they ever will be again. The Interstate concept is the cheapest solution to the problem of providing proper facilities for our highway traffic. This system, representing only 1.2 percent of our total highway mileage yet destined to carry 20 percent of all traffic when completed, has a capital cost of only 5.5 mills per vehicle mile—the lowest of any part of our federal aid system.

"Financing the Federal Aid Highway Program." Statement of Maj. Gen. Louis W. Prentiss, USA (Ret.), Executive Vice President, American Road Builders Association, before the Committee on Ways and Means, U. S. House of Representatives. *American Road Builder*, April, 1961.

Expressway Distributor

The five-and-one-half block long Third Street Distributor will be the heart of Cincinnati, Ohio's new expressway system. Traffic volumes in 1975 of 7200 vehicles per hour are expected from the three major expressways and Interstate Highway 75, all channeled into the downtown area within a few blocks of each other in an area adjacent to the Ohio River. In addition to these major arteries many industries along the water front will need to be served. Flood control provisions add to the complexity of the design problem. When completed the Distributor will cost about \$21 million, \$13 million being right-of-way expense, \$6.9 million construction costs and the remainder other expenses. As a part of Ohio's Interstate system,



Sign Up for 1981 in 1961 with embossed MIRO-FLEX STREET NAME ASSEMBLIES

The solid, permanence of MIRO-FLEX street name assemblies takes nothing away from their functional, smart styling. Our 1981 skyline may change drastically but the MIRO-FLEX sign installed today will stand the wear of weather and the tenure of time. These tough, durable units offer snap-out legibility combined with the extra strength and rigidity of embossing. Made of zinc-coated, Bonderized steel with baked-on enamel finish. They can be reflectorized with moisture-proof beads or reflective sheeting. MIRO-FLEX signs are the finest buy in the traffic control sign field. Competitive makes are...rarely so attractive...never so enduring.



THE **MIRO-FLEX** CO., INC. 1824 East Second
Wichita 14, Kansas

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Standard Traffic Signs Available for Immediate Delivery at Northeastern Warehouse
Koontz Equipment Corporation, 325 Ohio River Blvd., Emsworth, Pittsburgh 2, Pa.

Worth looking into...NOW!



ONE high-speed CASE® W-5 does
the work of two smaller rigs
...with up to \$2000 less cost!

Sounds almost too good to be true! BUT comparative tests *prove* that, under normal loading conditions, *one* fast-cycling Case W-5 loader, with 1-cu yd high-dump bucket, will move as much pay-yardage per day as *two* smaller capacity outfits mounted on conventional wheel tractors. In addition to saving an *extra* operator, the more powerful W-5 can save you as much as \$2000 in initial investment because: (1) it is engineered and built *specifically* for loading and stockpile work; (2) all major components — *including engine and transmission* — are quality-built by J. I. Case Company, instead of being purchased from "outside" sources.

70% more breakout... plus better machine balance and *double-heat treated, high-clearance axles* enable the Case W-5 to outperform any similar machine in its capacity range... without danger of axle failure. Rear-wheel power-steer, with short 10'4" turn radius, also insures greatly increased maneuverability.

See one in action... call your nearby Case Industrial Dealer today for a free W-5 demonstration. Ask him about the convenient Case finance and lease plans, with seasonal skip-payment privileges. Or, write J. I. Case Co., Dept F1341, Racine, Wis., for details.

You pay less than \$6700

For a full 1-cu yd loader with Torque-Converter Drive

Complete F.O.B. factory, gasoline-powered model, plus freight and taxes. Slightly higher in Canada. Price subject to change.

You get...

a rugged 3000-lb capacity front-wheel-drive loader with 1-cu yd (SAE rated) bucket, 188-cu in. Case-built gasoline or diesel engine, torque-converter drive, forward-reverse power-shift, rear-wheel power-steer. Comes equipped with big 13.00 x 24, 8-ply drive tires, standard 7.50 x 16, 8-ply rear tires, 12-volt electrical system, front and rear lights, usual instruments. *Optional extra-cost equipment:* 1 1/2-yd light material bucket, pallet fork, block fork, all-weather cab.



C-1-561

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THE ADVANCE-DESIGN TRACTOR LINE...12 MODELS...50 EQUIPMENT COMBINATIONS

financing will be on a 90 percent federal-aid basis with the city and the State of Ohio each paying five percent.

"Queen City Distributor System." *Highway Magazine*, April, 1961.

Other Articles

"Basic Principles of Pavement Design." This third and concluding part of the series includes a discussion of flexible pavement components, stresses, design and materials. By E. J. Yoder, Associate Professor of Highway Engineering and Research Engineer, Joint Highway Research Project, Purdue University. *PUBLIC WORKS*, May 1961.

"Urban Snow Removal Conference." Seven major eastern cities discussed snow removal problems and programs at the 1961 Round Table Conference on Urban Snow Removal held in New York City in March. *PUBLIC WORKS*, May, 1961.

"Principles and Fundamentals of Intersection Channelization." An effective, and often economical, engineering tool for providing safe, efficient traffic flow at points of conflict. By W. C. Kerr, Assistant Instructor, Michigan State University, East Lansing, Michigan. *PUBLIC WORKS*, May 1961.

"Tunnel Gets Automatic Signal System." Emergency traffic control and routine maintenance activities are im-

proved by new signal system for Baltimore Harbor Tunnel. By William F. Hallstead. *PUBLIC WORKS*, May, 1961.

"Light-Duty Asphalt Pavements Need Prompt Maintenance." Listed are some of the common distresses of light-duty asphalt pavements, their likely causes and the maintenance practices recommended by the Asphalt Institute. Roads and Engineering Construction (Toronto, Canada) March, 1961.

"An Urban Area Accepts the Street Challenge." The major street and highway plan developed by the City of Phoenix, Arizona. By Edward M. Hall, Street Improvement Administrator, City of Phoenix, Arizona. *Traffic Engineering*, April, 1961.

"Highways, a Special Staff Report." The history, international and national development of highway systems. Consulting Engineer, April 1961.

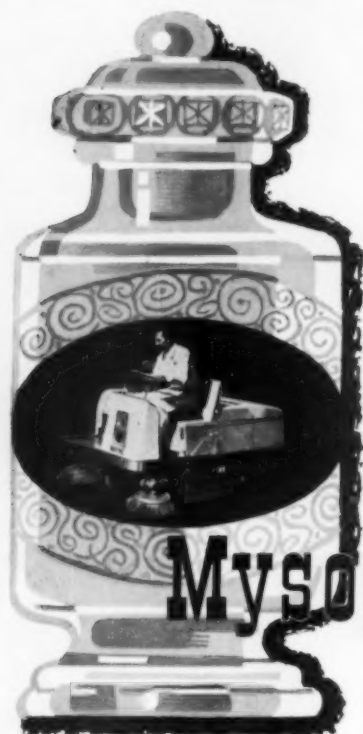
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Snowfall in New York City Last Winter

Under the title "Your Achin' Back," the New York City Department of Sanitation gives in *Sweep* the official U. S. Weather Bureau figures for snow fall in the 1960-61 season as follows:

Date	Depth
December 11	17.0
16	0.4
19	1.3
21	trace
24	trace
29	2.0
30	0.5
January 1	trace
15	1.0
16	1.0
19	4.4
20	5.5
23	0.5
24	0.5
26	3.5
27	0.3
31	trace
February 3	6.0
4	11.4
12	trace
16	0.8
26	trace
28	trace
March 1	trace
8	0.6
9	0.2
10	trace
13	0.4
18	trace
19	trace
22	trace
23	trace
Total	57.3

For purposes of comparison, Ridgewood, N. J., had 89 inches of snow, not counting a few trifling occurrences, according to M. J. Seeley, Village Engineer.



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cure
for
Mysophobia*

***mysophobia** (my' so-pho' bi-a) *n. Pathol.* 1. dread of dirt. Common among public works officials charged with good housekeeping in municipal parking lots, garages, on sidewalks around civic centers and parks, in sports areas, equipment yards, warehouses—wherever large Wayne street sweepers can't operate. Attempts to use old-fashioned pushbroom methods and costly manpower only aggravate condition. Cure invariably effected with Wayne Power Sweeper of proper size. Ease of operation, large hopper capacity, job to job portability, and savings in manpower and time, plus improved civic cleanliness with a Wayne have great calming effect. Prescription without charge obtained by writing direct to Wayne. Distribution, parts and service everywhere.



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Title _____
Address _____

NOW...the all-new BANTAM Compact 250

*the all-purpose machine designed
with tight budgets in mind!*



Here is a small-size, mobile crane-excavator that is so versatile, it's virtually a *one-machine fleet!*

The all-new BANTAM Compact 250 is ideal for public service jobs of all kinds—taking the place of many other single-purpose rigs, reducing equipment costs and manpower needs.

Here is a compact machine that gives you all the benefits of cable and hydraulic operation—to speed up trenching, loading, handling, cleanout and hundreds of other vital public service jobs. Works with a full range of fast-change attachments for greater job range. Entirely BANTAM-built, including new, rugged 4 x 4 carrier. Or mounts on your own 4 x 4 or 4 x 2 truck.

Put this new compact-sized, compact-priced machine of wider work range in your plans now. Mail coupon.

This is the BANTAM Compact 250:

- * Fully flexible truck crane-excavator—high speed mobility plus wider work range.
- * Lifts five tons . . . digs 100' of 5' trench per hour!
- * More versatile—unlimited job range with full convertibility: back hoe (cable or hydraulic-actuated bucket) . . . crane . . . dragline . . . clamshell . . . shovel . . . etc.
- * Ultra-simplicity—single-shaft machinery . . . cable-controlled digging-lifting operations . . . smooth, hydraulic 370° swing; foolproof mechanical controls.
- * Faster: swing, raise boom, work attachments—all at same time with BANTAM's independent action and fastest line speeds.



Heavy-duty BANTAM 350 series—Most popular crane-excavators in their class. Widely used by public bodies everywhere for heavy-duty 11-ton performance—preferred because of rapid travel, wide work range and low-cost maintenance. Work with 11 BANTAM-built attachments. Wide choice of BANTAM-built carriers. Also crawler and self-propelled models.

301 Park Street, Waverly, Iowa, U.S.A.



Bantam Co.

World's largest producer of truck crane-excavators



Please send me complete literature and details on:

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☐ BANTAM Compact 250.

☐ BANTAM 350 as ☐ Carrier Model, ☐ Crawler, ☐ Self-Propelled.

Name _____

Title _____

Address _____

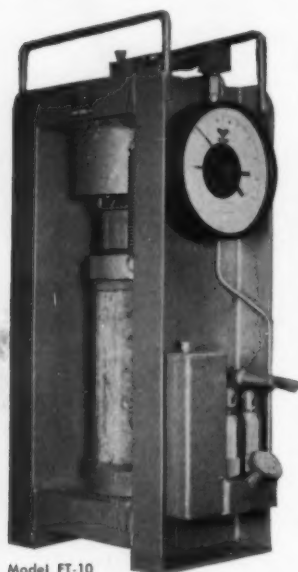
City _____

Zone _____ State _____

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Model FT-10

LOWEST priced tester with high priced features

- ✓ 250,000 lb. load rating
- ✓ Designed to protect operator from flying fragments
- ✓ Fully protected gauges equipped with instant connectors

Accessories available for:

- ★ 6" x 12" cylinders
- ★ 8" x 8" x 16" blocks
- ★ 6" x 6" beams
- ★ 6" x 6" cubes
- ★ 2" x 2" cubes
- ★ Compression and modulus of rupture of brick

"JOBSITER" is only one of a complete line of concrete testing machines. When better low priced testers are built—Forney's will build them.

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Bridge Railings Positioned With Epoxy

A NEW TECHNIQUE for positioning anchor bolts for the posts of railings on concrete bridge structures by the use of Sika Epoxy Bonding Compound is faster than the conventional methods and produces estimated savings of 20 to 30 percent.

This development precludes the necessity of positioning anchor bolts within the formwork prior to placing concrete. It also eliminates tedious and expensive fittings of railing posts, and when properly employed obviates the necessity for shimming.

This new technique was developed in the office of Carroll F. Blanchard, Deputy Chief Engineer (Bridges), New York State Department of Public Works. It was first used last summer on the Oneida Lake Bridge at Brewerton, N. Y.

The concrete fascia beam was cast 4½ ins. below final grade with the required tie bars protruding. Three 1-in. round anchor bolts were properly positioned and welded to a 7 x 11 x ½ in. steel plate. Sika Epoxy Bonding Compound was then applied both to a small portion of the concrete beam and to the plate. When the epoxy became tacky, the plate was placed on the epoxy prepared concrete surface. No pressure was required. The plates were positioned with the use of a carpenter's square, measuring from a previously chalked base line on the concrete beam's surface.

Working strength was reached in eight hours, at which time the railing post was attached to the anchor bolt assembly. Vertical alignment was accomplished using double nuts on the anchor bolts, one above and one below the railing post base. Longitudinal reinforcement was installed and a 4½ in. thick concrete cap was placed along the entire fascia beam.



SETTLE DUST



FASTER with Dow Calcium Chloride

You benefit three ways when you use Dow Calcium Chloride for dust control. 1. *Settle dust faster.* Both Peladow and Dowflake attract moisture fast, hold it in hottest weather to keep roads moist and free of dust. 2. *Stabilize unpaved roads.* You reduce gravel losses, blading costs by "fixing" loose surfaces with a moisture layer. 3. *Stop complaints.* Minimize traffic hazards caused by dust clouds which obstruct vision.

Start your dust-control program today with Dowflake or Peladow. Write for free brochure—"Progressive Improvement of Secondary Roads."

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94-97%
Calcium Chloride



DOWFLAKE®

77-80%
Calcium Chloride



THE DOW CHEMICAL COMPANY
Midland, Michigan



How mobile, multi-purpose Duo-Pactors are cutting costs for street and highway maintenance departments



The advantages of one investment, one operator, one machine to maintain for all compaction and surface rolling jobs, are evident. That's one reason why the Seaman Duo-Pactor is finding wider use among county, municipal and state highway departments.

But there are other and even more important advantages: Quality of compaction is improved. The Duo-Pactor provides narrow spacing between the tires of the pneumatic roll. This confines materials, preventing displacement and assures higher, more uniform densities in fewer passes than required with the average rubber-tired compactor. For this reason, the Duo-Pactor makes possible high-yardage, high-density compaction of stabilizations, gravel and crushed stone bases—even sand. Then, level, compact, and finish the surface with the steel roll.

For seal-coating, the Duo-Pactor with its narrow-spaced tires pro-

vides complete rubber roll coverage in fewer passes, at speeds to 10 mph.

Faster, more durable patching of chuck holes and repair of frost boils results from Duo-Pactor design: The closely spaced, small-diameter tires with torsion spring mounting densify patching materials, even in small holes that would be bridged by larger tires. Then, with the hole filled and compacted by rubber, just lower the steel roll to level the material flush with the surrounding surface. One job finished, drive the Duo-Pactor to the next location, carrying equipment and supplies.

DUO-FACTORS

Duo-Pactors—rubber and steel rolls combined in one low-cost machine—are available in sizes with ballast variable from 7 to 20 tons, 9 to 27 tons, and 10 to 30 tons. In addition, compressive pressures can be varied by on-the-go hydraulic adjustment of the wheel base. The 10-30 RD model is equipped with dump body for quick ballast adjustment or for use as a highway or off-highway materials hauler.



Model 10-30 RD Duo-Pactor compacting base for city street extension



Note imprint of Seaman Tri-Pactor's heavy vertical vibratory impact, rolling over previously compacted hard clay subbase for airport apron paving.

TRI-FACTORS

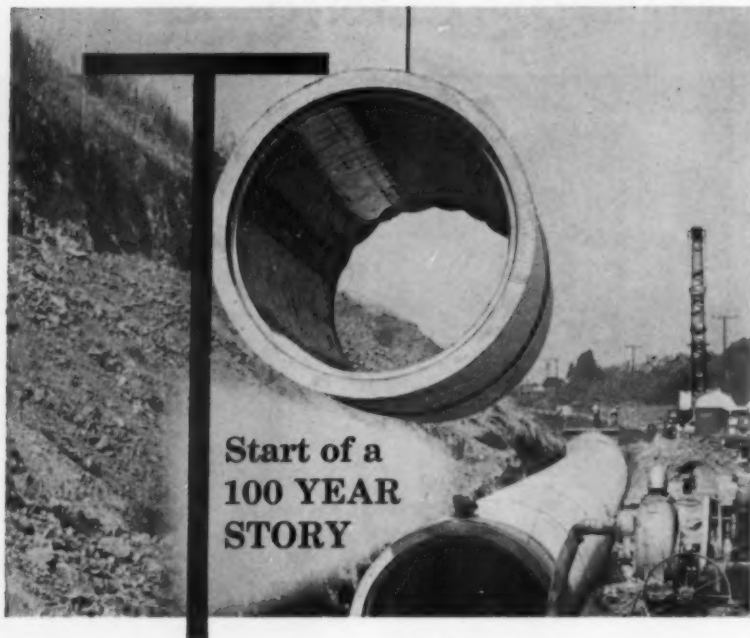
Where construction and maintenance conditions require vibratory impaction in addition to compaction with rubber and/or surface rolling with steel, the Seaman Tri-Pactor provides all three in one low-cost, self-propelled unit. One state highway maintenance department recently ordered its third unit. Tri-Pactors are available in models with ballast variable from 8 to 20 and 10 to 27 tons. Just touch the hydraulic control and convert the steel roll from a static surface roll to a deep-impact, vibratory roll delivering from 600 to 1,400 vertical impacts of up to 25,000 pounds per minute.

Please send me Specification Sheets as checked below:



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|--|--|
| <input type="checkbox"/> 7-20-ton Duo-Pactor | <input type="checkbox"/> Pull-type Vibratory Impactor |
| <input type="checkbox"/> 9-27-ton Duo-Pactor | <input type="checkbox"/> Self-Propelled Vibratory Impactor |
| <input type="checkbox"/> 10-30-ton Self-dumping Duo-Pactor | <input type="checkbox"/> Utility 6-yd. Scraper |
| <input type="checkbox"/> 8-20-ton Tri-Pactor | <input type="checkbox"/> Bituminous Distributors |
| <input type="checkbox"/> 10-27-ton Tri-Pactor | <input type="checkbox"/> Street Flushers |



Start of a 100 YEAR STORY

This reinforced concrete sewer will be in service generations from now, because concrete surpasses all other materials. Most concrete sewers do not require protection, but when strong chemical effluents or oxidized H_2S are a problem, only T-LOCK AMER-PLATE provides positive protection. T-LOCK AMER-PLATE is a high molecular weight polyvinyl chloride sheet which is cast into the concrete while in the process of manufacture.

T-Lock Amer-Plate meets all the requirements of the ideal sewer lining:

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- It is mechanically bonded to the pipe. Pull tests result in the breakage of concrete before T-Lock fails.
- T-Lock withstands 40 psi back pressure, equal to a ground water head of 85 feet.
- T-Lock has a smooth, highly abrasion resistant surface... maintains its N factor of .010 indefinitely.

There are no other materials—paints or troweled-on mastics, mortars, sacrificial aggregates or admixes—which meet these vital requirements.

Where protection is required, only T-Lock will do the job. Compromise methods are a gamble which experienced sewer designers will not take; they know it is money wasted to specify linings which will fail within a few years.

Because T-LOCK AMER-PLATE is the only completely satisfactory material on the market today, millions of square feet are now in use in cities throughout the nation.

For a complete list of users and specifiers, plus technical data, write:



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Photogrammetrists to Abandon Competitive Bidding

A policy that photogrammetric services should not be bid competitively has been adopted by the Association of Professional Photogrammetrists. In so doing, the APP agreed to accept the conditions of professional engineering status outlined by the American Society of Civil Engineers in a recent policy statement. Members will seek to meet licensing requirements so early implementation can be accomplished.

At the Reno, Nevada, meeting of its Board of Direction, ASCE said that civil engineers should no longer solicit competitive bids from photogrammetry firms for their services and that photogrammetric engineers should refuse to bid competitively for mapping projects.

The Association of Professional Photogrammetrists, which represents the major portion of private photogrammetric capacity in the U. S., concurred in this policy move.

"Photogrammetric mapping is logically a civil engineering activity of the highly specialized type which should be negotiated," A. O. Quinn of Aero Service said, "and there is no doubt that both photogrammetrists and their clients will benefit from working together under a professional relationship."

"Most important of these benefits is that the quality of photogrammetric mapping is certain to be improved. From now on, clients will be able to take into consideration the qualifications of the photogrammetrist, rather than being forced to accept the low bid, perhaps from a firm which has neither the experience or the equipment to do an acceptable job."

The services of private photogrammetrists have been much in demand in recent years by state highway departments (for location of new routes) and by other agencies requiring aerial maps for large construction projects. Much of the 41,000-mile Interstate System is being surveyed and mapped by photogrammetric methods at considerable savings in time and money.

Construction contractors have become increasingly concerned with the problem of accuracy in photogrammetric mapping because their bids must be based on earthwork quantities determined from aerial photographs. It is generally agreed that photogrammetric methods can produce very accurate determinations of earthwork quantities if the work is properly done.

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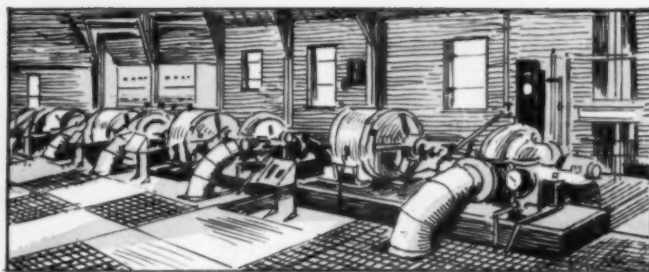
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THE WATER WORKS DIGEST



Prepared by **ALVIN R. JACOBSON, Ph. D.**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Annexation Problems

The rapid growth of the East Bay Municipal Utility District (EBMUD) water service area is typical of the expansion of the service areas of other water utilities throughout California. The early establishment of an ultimate service area boundary, enclosing an area of 400 sq. mi., has permitted EBMUD to plan its transmission and distribution system more thoroughly. From an original service area of 92.5 sq. mi., it has increased to a present service area of 245 sq. mi., through 139 annexations, ranging in area from approximately an acre to an unincorporated territory comprising over 20 sq. mi. These accomplishments may be attributed to: 1) Establishment of a close advisory relationship with duly elected boards and water committees. 2) Careful planning of each step of the annexation procedure and each phase of the providing of water service. 3) Determination of the definite assignments to be accomplished, including the preparation of a check list of these for the guidance of district personnel and the establishment of a deadline for the completion of each assignment. 4) Immediate alerting of all concerned when decisions are made that affect the course of action. 5) Recording the results of contacts made with area and utility representatives to keep EBMUD personnel informed. 6) Maintenance of a proper follow-up of any problems that develop. 7) Close working with legal counsel to avoid legal pitfalls. 8) Maintenance of an intelligent liaison with the representatives of the local area and existing utilities. 9) Keeping the electorate and their representatives well informed through letters, press releases, and group meetings.

"Problems of System Expansion by Annexation". By H. Buford Fisher, Staff Assistant, East Bay Municipal Utility Dist., Oakland, Calif. *Journal AWWA*, April, 1961.

St. Paul's Programs

Increased water demands resulting from a decrease in ground water usage by many industrial and commercial establishments, plus an increase in air conditioning and a rise in general over-all per capita domestic use made it necessary for the city of St. Paul to speed up construction programming 10 years ahead of schedule. The average daily requirement in 1953 was 36.9 mg while the maximum demand was 65.5 mgd. In 1961, the average demand had increased to 42.8 mgd and

the maximum requirement was 87.8 mgd. This increase in water usage was experienced with an insignificant increase in population of only 0.69%. St. Paul obtains over 80% of its water from the Mississippi River and the remainder from a group of lakes. While the raw water contains some color, the turbidity is usually not more than a trace. Algae growths do occur in the lakes but is effectively controlled by the addition of copper sulfate. McCarron Station, which includes the filter plant and treated water pumps, is where the water is softened, filtered, chlorinated, and fluoridated before being pumped into the distribution system. The additions to the plant in 1957 included a new chemical house containing three steel lime storage tanks with a capacity of 70 tons each; two 4,000 pounds-per-

Water Meters Read Through Glass Block



WATER METER reading time has been cut in half at Centex Construction Company's Elk Grove Village by mounting meters so they can be read from outside the homes.

Located 25 miles northwest of Chicago's loop, Elk Grove now has 2600 homes. Centex plans to develop a community of 11,000 homes. All of the homes have Rockwell Sealed Register water meters installed in the crawl space. Water meters are tilted at a 45-degree angle for easy reading through a glass block built into the foundation.

Glenn Snyder, manager of the Elk Grove Sewage and Water Department, estimates that this method of water meter installation cuts meter reading time in half.

Gas meters can also be read from outside, since they are mounted in the garage near a window. The electric meter is usually mounted outside, so all utility meters can be read without entering a house.

Darling
B-50-B Hydrants
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 for exceptional
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Darling B-50-B Hydrants are available in types and sizes for practically every installation. Write for Bulletin 5710.

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PUBLIC WORKS for June, 1961



hour feeders and slakers; and two rapid mixing basins with mechanical mixers. Two new flocculation basins were constructed following the two rapid mixing basins. Both new and old flocculation basins were equipped with paddle mixers of the longitudinal type. An additional covered sedimentation basin, equipped with straight-line sludge collection equipment, was constructed at the same time. A new control laboratory, offices, and a meeting room were included in this contract. In 1960, two additional sedimentation basins each similar to the one completed in 1957, and six new filters, were

completed bringing a plant capacity that will permit treatment rates in excess of 100 mgd.

"St. Paul Telescopes Its Construction Program". By G. R. Scott, Principal Engineer, Black & Veatch, Consulting Engineers, and L. N. Thompson, General Manager, St. Paul Water Department. *Water Works Engineering*, April 1961.

Water Stabilization

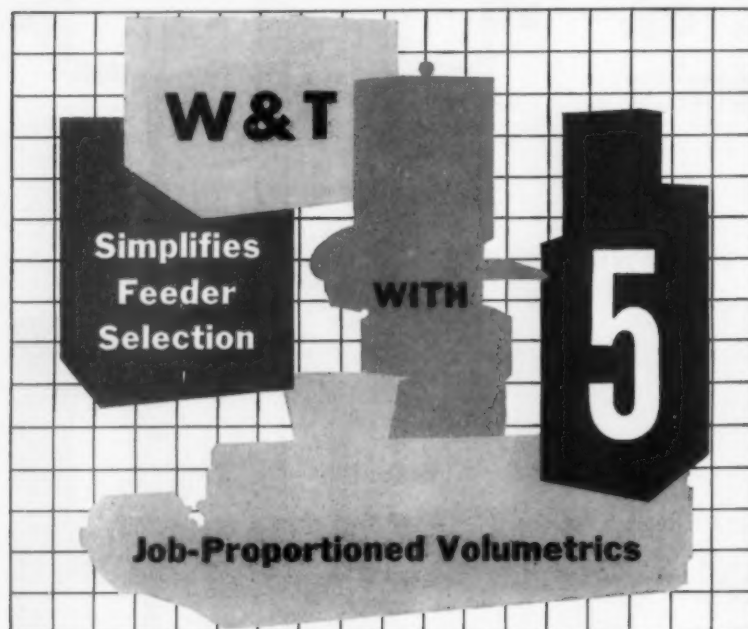
In the stabilization of lime-softened water to make it non-incrusting on filter sand, water distribution

systems, or hot water systems, the water plant operator must be concerned about the corrosive properties of water as well as about the possibilities of scale deposition. The water treatment objective at the St. Louis County Water Company is: To produce a water which has a total hardness of 100 ppm (as calcium carbonate) or less, which will be non-corrosive and will not incrust the filter sand, the distribution system, or domestic hot water systems when the hot water heaters are operated at 140° F. or less and the detention time in the heater is no longer than 24 hours. Laboratory studies were undertaken to determine: 1) The chemical characteristics of a water which will meet the requirements of the above conditions; 2) the processing required by Meramec River Water to produce such chemical characteristics; and 3) the plant flow sheet arrangement and plant design which will produce such a water economically. From pilot plant and laboratory jar testing it was concluded that the Meramec River water can be lime-softened so that it is stable at 140° F. by treating approximately 75 percent of the water with 0.5 milliequivalents per liter excess lime in the presence of 3½ to 4 percent recirculated slurry, by bypassing approximately 25 percent of the raw water and taking advantage of normal coagulation and chlorine dosages for additional pH reduction. This treatment utilizes lime efficiently and enables the water plant operator to produce a quality product with the minimum of capital investment for chemical treating facilities. The present water treating equipment can be adapted to the process.

"Split Treatment for Stabilization". By J. L. Tuepfer, Supt. of Purification, St. Louis County Water Co., University City, Missouri. *Water & Sewage Works*, April, 1961.

Controlling Tastes and Odors

Taste and odor problems in water supplies can ordinarily be handled by plant personnel if: 1) the raw water supply is from a satisfactory source; 2) the plant is built to provide needed flexibility of operation; and 3) the equipment has the capacity needed to feed ample treatment chemicals to proper points in the plant. The lack of these three qualities in the water system of the city of Waxahachie, Texas, plagued their operations for taste and odor control in the summer of 1960. Prior to 1957, the entire water supply had



Whether you feed ounces or tons of dry materials per hour, W&T makes feeder selection easy. There's a W&T Volumetric with exactly the capacity you need. Choose delivery rates of an ounce to 90 tons per hour. And feed rates are adjustable over extremely wide ranges.

W&T Volumetrics have vibrating hoppers, diaphragm agitators, and guide vanes in various arrangements to keep materials flowing. Stainless steel rolls or self-cleaning feed screws keep delivery constant and uniform. A belt-type volumetric is particularly effective for lumpy materials.

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Kennewick, Washington...10-million gallon prestressed concrete water tank with timber supported corrugated asbestos roof. This tank is 248' x 19'. The floor slab is 10' below the footing and is saucer shaped with the sloped portion joining the footing wall. Tank design and prestressing by The Preload Company. Mr. Tim deJong is City Engineer; Lewis Hopkins Co., Pasco, Washington was general contractor.

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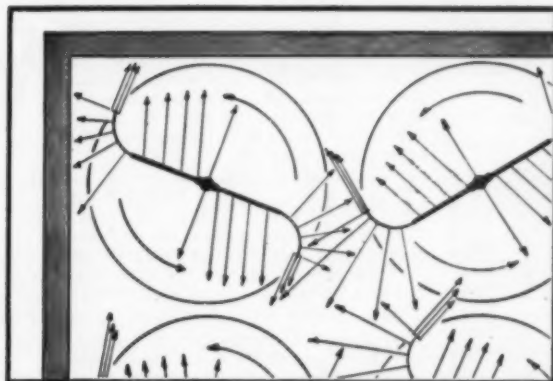
Actual field tests show the new S-Type unit gives a 25 to 30% further increase in filter cleaning efficiency, with resultant increase in over-all plant efficiency. The old straight arm type of Agitator increased filter production beyond filter design. And now just a moment's study of the sketch below will show how much better this newly-designed S-Type will perform.

With it each of the corner and void areas will now receive **four** agitating impulses per revolution instead of two with the old style straight arm, thereby doubling the cleaning action in these areas. See drawing below.



Portion of an
S-Type Filter
Arm in
actual service
(patent pending)

New S-Type Filter Arms double the cleaning action.



COMPLETE COVERAGE OF ENTIRE FILTER AREA

See how the jets on the forward and following curved portions of the rotating arms give complete coverage of the entire filter area. Nozzles are now also angled downward and outward from the center to create a positive recirculation of expanded media throughout the entire filter bed. As a result no portion of the filter media is excluded from thorough cleaning action.

CAN BE ADAPTED TO OLDER UNITS

The design of the S-Type installation is such that older units in service can be modified to take full advantage of the advanced features. The past records of Palmer equipment are your assurance of satisfaction. The new model will carry the same guarantee of minimum operational cost. Replacement parts last year totaled slightly over \$1,200, for well over 15,000 units many of which have operated for 10 to 25 years.

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been obtained from deep wells, but with an increased demand it was necessary to turn to a surface source. An earth-fill dam was built on the South Prong of Waxahachie Creek. Heavy rains (over 25 inches in two months) filled the lake to the spillway level before any of the vegetation was removed from the site. Taste and odor problems were of minor significance in 1957 and 1958 but in July, 1960, intensities increased more than the plant could handle by conventional methods. Jar tests in the laboratory showed that potassium permanganate gave good results in taste and odor re-

moval. The addition of activated carbon was discontinued and 0.375 mg/L of potassium permanganate was added reducing the threshold odor from about 40 to less than 2. After about 10 days the potassium permanganate dosage was increased to 0.50 mg/L; then it was increased to 0.75 mg/L which proved sufficient to handle the taste and odor problem. Tests for potassium permanganate are very simple. An approximate dosage can be determined by simple titration. The purple color serves as an indicator simplifying control of permanganate dosage. Permanganate does not combine

with the substances causing taste and odor but acts as an oxidizing agent. The residual manganese dioxide is insoluble, is absorbent, assists the coagulation process and is removed by coagulation and filtration.

"Water Supply Tastes and Odors Controlled by Potassium Permanganate". By J. L. Smith, Water and Sewer Superintendent, Waxahachie, Texas. PUBLIC WORKS, May, 1961.

National Water Resources

A summarization of the situation with respect to the nation's water resources indicates that serious problems lie ahead. The provision and management of water supplies for waste disposal, irrigation of arid lands, outdoor recreation and the conservation of fish and wildlife appear to pose the most serious water problems. It is important that plans be made to meet demands before they arise, so as to avoid any retardation of economic activity in particular localities because of a deficiency in water development. Five major categories of effort needed are: 1) Regulating stream-flow through the construction of surface reservoirs and watershed management. 2) Improving the quality of our streams through more adequate pollution abatement programs. 3) Making better use of underground storage. 4) Increasing the efficiency with which water is used through elimination of wasteful practices, improved sewage treatment methods, recirculation, increased irrigation efficiency, and substitution of air for water cooling. 5) Increasing the natural water yield by desalting, weather modification, and other artificial means. It is hoped that appropriate legislation will be forthcoming to implement the five recommendations made by the Senate Select Committee on National Water Resources.

"Summary Report of Senate Select Committee on National Water Resources". By Robert S. Kerr, Chairman, and Thomas H. Kuchel, Vice-Chairman. *Journal AWWA*, April, 1961.

Mechanizing Filter Plant

The modernization of the New Orleans conventional filtration-softening plant is the latest step in the development of a potable water supply system, dating back to the early 1800's. Work on the plant began with the formulation of plans

FOUR reasons why Ford covers offer greater protection and convenience for every meter box installation . . .

1
2
3
4

DOUBLE LID METER BOX COVERS

Designed to provide the utmost in frost protection for pit meters, the "Wabash Cover" has a total depth of 9½ inches. Its extra depth, sloping skirt and 4" dead-air space between inner lid and top lid minimize heat loss from the top of the meter setting.

These covers can be provided in "standard weight" for ordinary service, or "extra heavy," when the lid will be exposed to traffic.



SINGLE LID METER BOX COVERS

Designed for sidewalk or lawn installation, Ford "Type A" covers are made for 15", 18", 20" and 21" meter boxes. Lids are inset.

Lifter Worm lock used on these covers helps speed meter readings. Screw jack action plus automatic attachment of the key to the bolthead make lid removal a simple, clean task.



MONITOR COVER

Designed for use on large tile — where a large lid opening is desirable — "Monitor Covers" consist of 1) a flange casting to fit on the tile, 2) a ring centered in place on the flange by a circular bead, and 3) a top lid with Lifter Worm Lock.

These covers can be used for 1½" and 2" meters . . . or for two or more smaller meters. Lid size permits meter reader to enter setting if necessary.



HINGED LID

Designed for same installations as other single lid covers, "Type X cover" features hinge effect so lid can simply be leaned back instead of lifted off while meter is read.

Simple, ingenious lugs in the frame casting pivot the lid and support it. Thus, if desired, it can also be completely lifted off.



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Like all R. D. Wood Hydrants, the oldtimers are of simple but sound construction; their operation cannot be impaired by foul weather, snow, sleet, ice or silt. Apart from the hazard of being in the path of a truck out of control or the possibility of street relocations, there is no foreseeable trouble ahead for them for many more years. There has never been better fire protection for any community than R. D. Wood Hydrants.

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whereby the following alterations and additions could be systematically made: 1) Selection of a treatment process that could utilize the 10 existing reservoirs in their relative locations. 2) Reduction of hydraulic losses throughout the process and between the various stages of treatment. 3) An increase in chemical feed capacity. 4) Revision of methods for sludge removal and handling. 5) An increase in filtration facilities. 6) An increase in clear water storage. The plan adopted was to modify and add the necessary facilities to double the 112 mgd capacity plant. This was ac-

complished by adding mechanical coagulation and sludge removal equipment to the 13 sedimentation basins without interrupting service. Six mechanical coagulation units were placed in each basin. Raw water enters a bar-screened entrance flume where a hydraulic jump mixes coagulant and pre-chlorine doses. Treated water is then uniformly distributed along the bottom of the basin by the six treatment rotors, where it is mixed and stirred with a maintained sludge blanket. Milk of lime is also introduced within the sludge blanket by a series of distribution hoses. Over

the last six years the expansion of the treatment, filtration and storage facilities have been made without interruption of operation. This has been accomplished by systematic planning of construction programming operations.

"Mechanizing a Filter Plant Without Disrupting Service". By Crawford J. Powell, Assistant General Superintendent, Sewerage and Water Board, New Orleans, La. *Water Works Engineering*, April, 1961.

Other Articles

"Hypochlorite Feeding Equipment". Part IV. This article concluding the series, pertains to equipment used for dispensing hypochlorites for disinfection and other treatment objectives. By Edmund J. Laubusch, The Chlorine Institute, Inc., Technical Manager, New York, N. Y. *Water & Sewage Works*, April, 1961.

"USAF'S Water Fluoridation Policy". Since fluoridation is directed at children's improved dental health, the requirement for fluoridation depends on the number of housing units served to be economically feasible. By Francis A. Sanders, Lt. Col., USAF, Chief of Operations Division, USAF Ohio River Civil Engr. Region, Cincinnati 6, Ohio. *Water & Sewage Works*, April, 1961.

"How Much Water Do We Have? How Much Water Do We Need?" Here are the facts about rainfall, runoff and reserves—and the challenge of water management. By O. D. Mussey, Hydraulic Engineer, U. S. Geological Survey. *Water Works Engineering*, April, 1961.

"Monitoring the Lower Mississippi". New warning network alerts municipal water users of accidental river pollution. By John E. Trygg, Director, Division of Public Health Engineering, Louisiana State Department of Health. *PUBLIC WORKS*, May, 1961.

"Landscaping for Water Utility Structures". A Joint Discussion presented on Oct. 27, 1960 at the California Section Meeting, Long Beach, Calif. By William T. Hartman, Land Maintenance Supt., East Bay Municipal Utility Dist., Oakland, Calif. and Fred Tschopp, Supervisor of Horticulture & Landscaping, Dept. of Water & Power, Los Angeles, Calif. *Journal AWWA*, April, 1961.

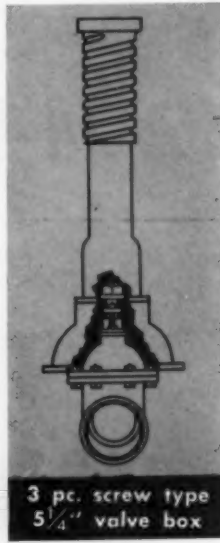
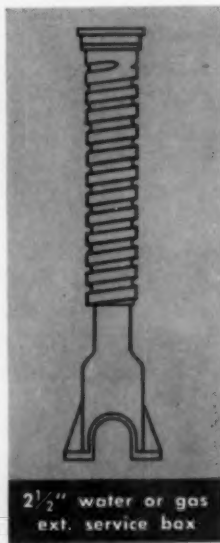
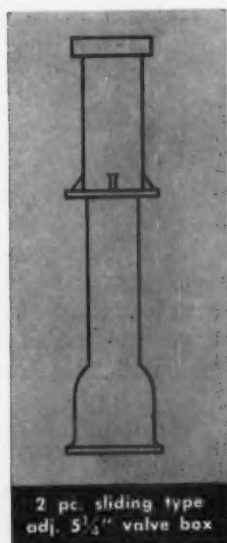
"Electrophoretic Studies of Turbidity Removal by Coagulation With Aluminum Sulfate". A report of an investigation of the relationship of particle zeta potential and coagulation in dilute clay suspension as the alum dosage and pH were varied. By A. P. Black, Research Professor of Chemistry & Sanitary Sciences, and Sidney A. Hannah, Research Asst., both of Dept. of Chemistry, University of Florida, Gainesville, Fla. *Journal AWWA*, April, 1961.



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how Daly City solved sand problems

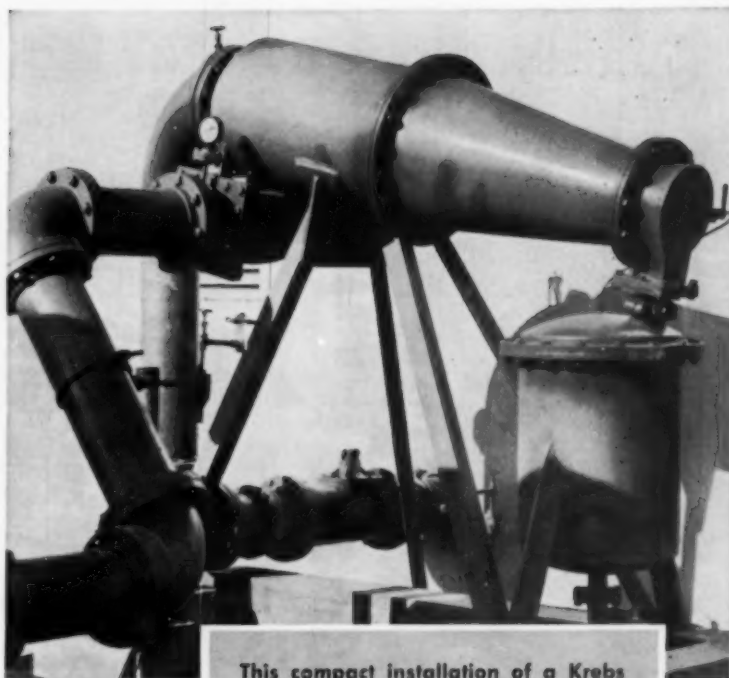
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- booster pump wear
- settled sand in pipes

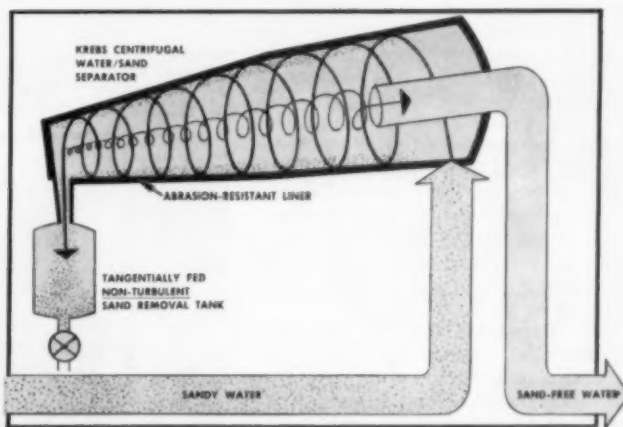
After installing a Krebs centrifugal water/sand separator*, the Daly City, California, municipal water system found immediate benefits in increased revenues and reduced maintenance costs. Their Krebs separator removes 97.8% of the total solids from the well water, and essentially all of the objectionable sand. The unit's efficient separating action results from optimum use of centrifugal force through the cyclonic principle as applied in the exclusive Krebs separator design. Krebs cyclones are accepted as the standard throughout the world in the field of dynamic classification.

Krebs separators are available custom-sized for any municipal well water system. They have no moving parts, require no maintenance, and utilize special sand-resistant liners which will last many years. Installation is simple, and needs a minimum of floor area and headroom. Integral mounting supports are provided; no special platform or framework is required.

*Patent applied for



This compact installation of a Krebs centrifugal water/sand separator, in Daly City, California, replaced two conventional sand traps, and provided substantially increased removal of fine sands.



Write today for descriptive bulletin. Specific recommendations for your own system are available without obligation.



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A County Highway Mowing Program

MAINTEINING over 515 miles of secondary roads is a rugged assignment requiring specialized equipment as Edwin L. Carpenter, Road Supervisor of the Burlington County (New Jersey) Highway Department, will quickly emphasize. Not the least of his seasonal maintenance problems is that of mowing the grass and underbrush that line both sides of over 400 miles of the highway network under his jurisdiction.

Good grass growth, so essential to erosion control, is also a matter of civic pride in keeping with the county's renown as the "Garden Gate of the Garden State." Maintaining the roadsides is complicated by the widely varying terrain and obstacles of both natural and man-made origin. The ever-present problem of litter along the highways complicates the maintenance responsibility and strains existing facilities and personnel. Such things as cans, bottles and other "unmowables" can raise havoc with mowing equipment not specially designed for highway service.

The Burlington County program calls for two to three mowings per season along the 400-mile highway system. The annual budget for this operation averages \$30,000. To carry out this program, Mr. Carpenter's maintenance group operates a total of seven tractor-mounted hydraulic cutter bar mowers including one Triumph and six Anderson units. Long experience has convinced them that hydraulic cutter bar mowers will withstand the abuse and provide the essential maneuverability for cutting slopes and embankments as well as uncertain terrain.

Mr. Carpenter stresses the importance of maintaining equipment in first class condition and especially the mowers which are subjected to constant punishment. Low maintenance is one of the key factors that have dictated purchase of mowing equipment in recent years. Because of the large amount of mowing required by the department throughout the county, he points out that they cannot afford down-time for major repairs or overhaul.

"We've found that aside from regular knife changing," Mr. Carpenter states, "there has been an exceptionally low incidence of maintenance with our Anderson mowers." To make sure that the mowers are kept operating at close to peak

efficiency, each tractor is sent out with a spare blade. Should replacement be necessary during the day, as it generally is, the spare blade can be pressed into service in a matter of minutes.

To accomplish this, the cutter bar breakaway latch is tripped and the bar swung to the rear. Removal of the old blade is done quickly and the sharpened one replaced simply by sliding it into position and engaging

the pitman and ball on the knife head. This is done on the right side of the tractor, completely away from traffic, for convenience and safety.

"Because of the rugged demands of secondary highway mowing," Mr. Carpenter added, "we feel that our mowers could be used practically anywhere. We've solved our mowing problems, and find our Anderson mowers well suited for secondary road maintenance."



● ILLUSTRATING what happens when some of the unmowable objects along roadsides are encountered—the cutter bar gives way when it strikes a rigid object.



● CUTTER bar knife is quickly removed. Each unit carries a spare blade and when replacement is necessary only a few minutes are required for making the changeover.



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Measure-Rite worked with Orange County engineers to install the giant meter without any shut-down of the flows, waiting till tide conditions were lowest.

Orange County is typical of Measure-Rite's ability to custom-tailor meters to special requirements. Propeller meters — featuring the free-flow design — are also available for jobs up to 250 psi. Write for descriptive literature.

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Lift Stations, Sewage and Odors

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Superintendent,
Water Treatment and Sewage
Disposal Plants,
Lake Worth, Florida

THE FIRST, we pay money for. The second is given to us with a bonus. The third, odor, is the nightmare of the industry.

Funds are willingly spent in an attempt to reduce odor, to confine it, to mask it and to prevent it. Regardless of our efforts, some will get out to the neighbors during a lawn party or an afternoon tea. Then, the phones start ringing—the Mayor is upset, the City Commissioners start asking questions, and the City Manager wants action—not tomorrow or next week but now, be it midnight or three a.m., while the wind is from the east.

Knowing that 90 percent (and I wouldn't question 95 percent) of all sewerage odors can be eliminated by good housekeeping, and having done that, we are faced with the problem of the 10 percent. We have tried the field of masking agents, from ozone to inhibitors, and have tried just a little better housekeeping, but to no avail.

Then while painting the lift station floors we noticed that the nightmare was gone. Being curious, we inquired about the ingredients of the paint we were using, which was made by a local manufacturer.

To our surprise, we learned that for years vanilla extract has been used in the paint business as a masking agent. After convincing our Purchasing Agent we had not "flipped our lids" we bought a quart of vanilla extract, 35 percent alcohol, and proceeded to spray (diluted 1-20).

Now we have a candy kitchen instead of a lift station! Try it and let me know. It may work for you.

• • • **Cost of Sewage Treatment**

The total net cost for operating the Cranston, R. I., sewage treatment plant, Walter C. Anderson, Supt., was \$70.33 per million gallons during the year ending Sept. 30, 1960. This is an activated sludge plant and the average flow was 4.32 mgd or 94 gpcd.

PUBLIC WORKS for June, 1961



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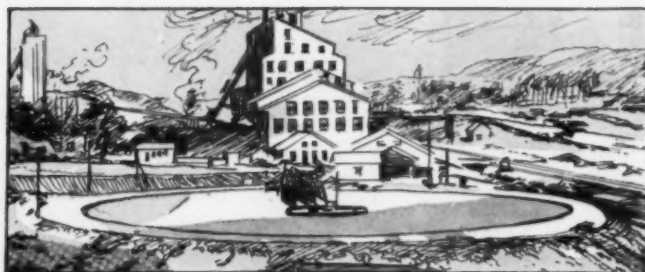
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THE INDUSTRIAL WASTE DIGEST



Prepared by CLAYTON H. BILLINGS, Associate Editor

Tests for Carcinogenic Nitrogen Compounds

Increasing numbers of organic nitrogen compounds known to contribute to cancer in animals are being released to the human environment. It is desirable to develop methods for detecting and determining quantitatively and quickly such compounds. A general procedure has been developed for aromatic primary amines, aralkyl amines, aryl dialkylamines, indoles, carbazoles and phenothiazine compounds. It involves spot plate and paper techniques and colorimetric titrations using methanol solutions of the sample and 3-methyl-2-benzothiazolone hydrazone hydrochloride and ferric chloride as reagents. Most aniline derivatives react readily to produce a range of distinguishable color characteristics with these reagents.

"Spot Test Detection and Colorimetric Determination of Aromatic Amines and Imino Heteroaromatic Compounds with 3-Methyl-2-benzothiazolone Hydrazone." By E. Sawicki, T. W. Stanley, T. R. Hauser, W. Elbert and J. L. Noe, R. A. Taft Sanitary Engineering Center. *Analytical Chemistry*, May, 1961.

Stripping of Volatiles In Petrochemical Wastes

In the biological treatment of petrochemical wastes by aeration, the mechanism appears to involve removal of the volatile components by stripping as well as by oxidation. Previous experiments (reported in the February, 1961, *Journal WPCF* and *PUBLIC WORKS Industrial Waste Digest*, April, 1961) indicated that stripping of two compounds, acetone and butanone during diffused air aeration followed first order kinetics. This work has been extended to studying other volatile compounds to determine if the relation-

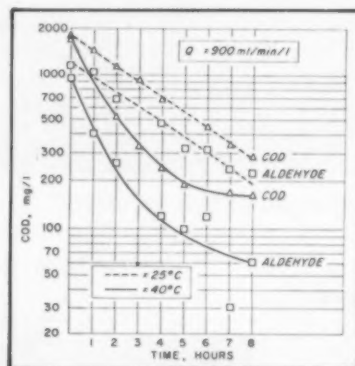
ship continues to hold. The effect of temperature, tank geometry and unit air flow rate on removal by stripping were studied. It was found that while acetone, butanone and propionaldehyde, at 25°C, are removed at a rate which is constantly proportional to the amount remaining at any time, propionaldehyde and other aldehydes were not, at 40°C. This is typified by the divergence of COD and aldehyde removal curves as the length of the aeration period at 40°C is extended. Probably oxidation of the aldehyde to acid occurs at the higher temperature and this remains in solution to contribute to the COD. In considering the effect of unit air flow rates, in terms of ml. per min. per liter on the overall transfer coefficient, k_a , it was found that the expression $k_a = k_{a0} + RO_a$ is more generally applicable than the widely accepted $k_a = CO_a$. The latter equation appears to break down with variability in tank geometry, when the mode of mass transfer changes from bubble diffusion alone to partial diffusion from the atmosphere. Regardless of the order of reaction of the aldehydes, substantial COD removals were effected, 85

to 98 percent, with 8 hrs. aeration at 25°C and at an aeration rate of 900 ml. per min. per liter.

"Stripping Kinetics of Volatile Components of Petrochemical Wastes." By A. F. Gaudy, Jr., R. S. Engelbrecht and B. G. Turner, U. of Illinois. *Journal WPCF*, April, 1961.

Dairy Waste Treatment Developments

The latest research on treatment of dairy wastes has been in the fields of bio-oxidation and irrigation. The Eastern Regional Laboratories of the Dept. of Agriculture are studying the possibility of utilization of whey. The Dairyman's League Cooperative Association installed at Horseheads, N. Y. a continuous flow bio-oxidation plant in 1955. Except during periods when accumulated sludge is discharged with the effluent, very high BOD removals have been obtained. It was first considered that sludge would be continually oxidized, but results have shown that a one percent build-up can be expected. A dairy waste treatment system should include screening, grit removal and equalization equipment in addition to that for bio-oxidation. During 1958, 1.4 billion pounds of cheese were produced in the United States resulting in 0.9 billion pounds of whey, of which less than 20 percent could be converted to powder for re-use. At the Graoe Dairy in western New York, whey waste disposal by spray irrigation was tried unsuccessfully. The proteins coagulated the upper layers of the soil resulting in ponding and odors. A treatment process consisting of centrifugal separators was developed, using first vacuum degasification, heating and pH adjustment. The centrifuge removes the precipitated protein which can then be used as an animal food supplement. Evaporation is being considered by a dairy on the West Coast. It is proposed to



● CURVES show the rate of stripping of propionaldehyde at 25 and 40°C.



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concentrate 18,000 pounds of liquid wastes containing whey and averaging 0.71 percent solids to 255.6 of 50 percent liquid. This is expected to result in a marketable product.

"New Developments in Dairy Waste Treatment." By C. W. Watson, Jr., Dairymen's League Co-operative Association. *Industrial Water and Wastes*, March-April, 1961.

Air Force Wastes Treatment

Nearly all Air Force bases generate liquid wastes principally from

aircraft repair operations. Others result from research and testing. They consist of oil, chromium and other toxic metal solutions, cyanides, alkalis and acids, organic solvents, rocket propellents and radioactive solutions. One of the biggest problems stems from airplane cleaning and washing. Formerly the solvent emulsion cleaners used including kerosene, created stable emulsions which required segregation of airplane washing areas and pressure flotation equipment for treatment of the wastes. This problem has been solved by substituting an alkaline water base cleaning compound for

the one requiring the use of kerosene.

Phenols are oxidized by chlorine in alkaline solutions and conventional methods are employed for cyanide and chromium removal where lack of suitable municipal facilities requires establishment of treatment plants. At Olmstead AFB, petroleum and organic solvent wastes are accumulated and sold for reclamation by private interests. Chrome wastes are recovered at Hill AFB. The problems involved in handling missile propellant wastes are disposal of nitric acid, hydrogen peroxide, aniline, alcohol and ethylene oxide. These bases are in isolated areas permitting on-site disposal operations. Nitric acid is neutralized with limestone; aniline and alcohol are incinerated or burned on the surface of the ground. Ethylene oxide and hydrogen peroxide are disposed of by atmospheric and surface water dilution, respectively. Radioactive wastes are handled in the conventional manner.

"From 'Wings to Wastes.'" By F. A. Sanders, Lt. Col., USAF, Chief Operations Division, USAF Regional Civil Engineer Office, Cincinnati. *Wastes Engineering*, April, 1961.

Chlorine Demand Tests On Industrial Wastes

Studies involving the several methods of determining the chlorine demand of an industrial waste were made to assess the reproducibility of results. The tests are significant since chlorine demand is used as a basis for charging for treatment. The waste employed in the studies originated from flax pulping and included a mixture of wash waters, white water and black liquor from paper manufacture. The BOD averaged 924 mg/L and suspended solids, 963 mg/L. Chlorine demand may be determined by the orthotolidine test or the amperometric method. Chlorine requirement for bacterial destruction is a third alternative. For the orthotolidine test, samples had to be diluted 10 to 1 to avoid masking of the result by the color of the undiluted waste. Consequently the amperometric method was run on both diluted and undiluted samples of the waste to evaluate the effect of dilution. The criteria used were dosages of chlorine required to produce a 0.1 mg/L after 15 minutes contact. One series of tests was made to determine the chlorine dosage necessary to produce a 5 mg/L residual after 15 minutes contact. The bacteriological chlorine require-



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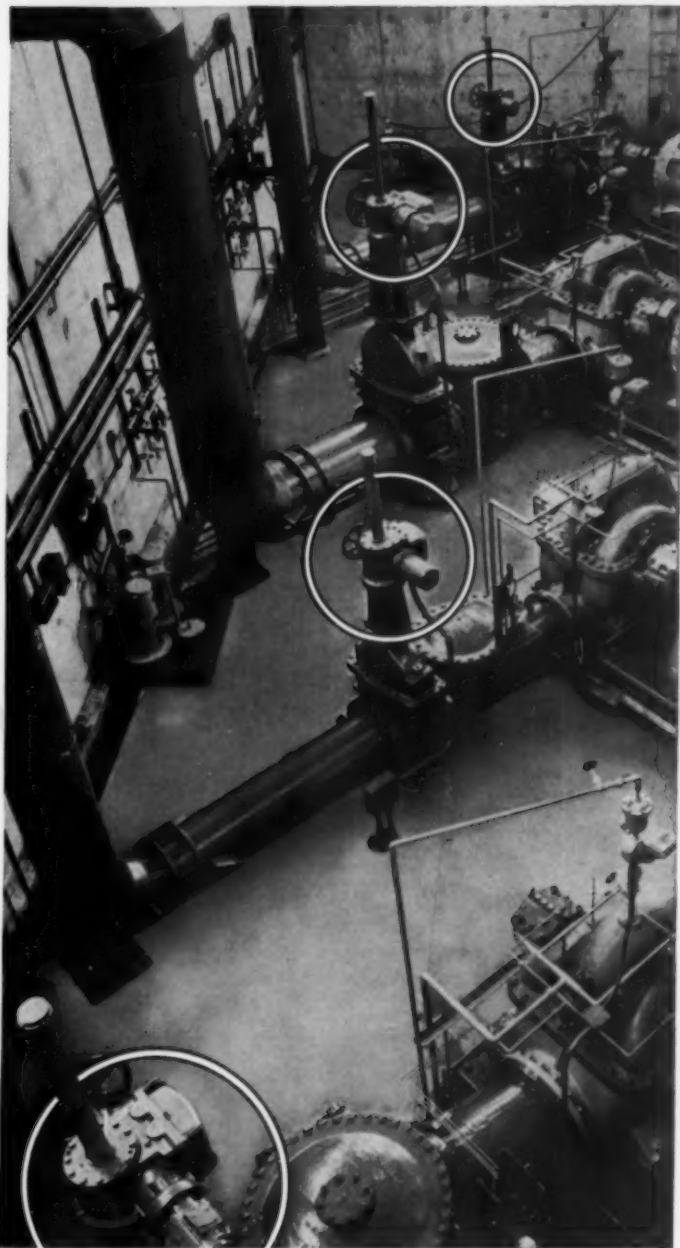
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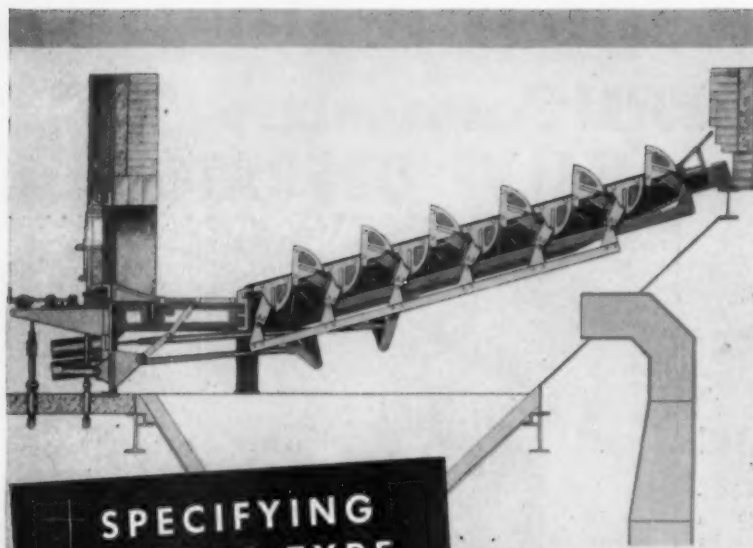
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ment was measured in terms of the chlorine dosage needed to reduce the coliform index of the mixture to 10 organisms per 100 ml, performed on the waste diluted with 10 percent domestic sewage. The tests were made independently by two laboratories on a number of samples. It was found that the orthotolidine test yielded results of good reproducibility and that dilution of the waste had no appreciable effect on the results. The findings by the bacteriological chlorine requirement test agreed well between the laboratories and with results of the orthotolidine test. The amperometric methods showed wide disagreement in results between laboratories and yielded lower values generally than the other two methods.

"Comparison of Chlorine Determination Methods in Waste-Waters." By M. C. Rand, Associate Prof., Syracuse U. and J. V. Hunter, Rutgers U. *Journal WPCF*, April, 1961.

Other Articles

"Determination of Nonaromatic Unsaturates in Automobile Exhaust by Spectrophotometric Titration." By P. D. Mader, K. Schoenemann and M. Eye, Los Angeles County Air Pollution District. A method has been developed for detecting high molecular weight olefins in gas mixtures by absorption of the free tribromide ion in ultraviolet. *Analytical Chemistry*, May, 1961.

"Acrylonitrile and Zinc Wastes Treatment—Part I." By R. D. Sadow, Dow Chemical Co. Design criteria are given for a plant successfully treating synthetic textile wastes. *Industrial Water and Wastes*, March-April, 1961.

"Treatment of Bearing Manufacturing Waste." By L. C. Geyer, Link-Belt Co. A batch industrial waste treatment plant followed by biological treatment is used by the Link-Belt Co. at Indianapolis. *Industrial Water and Wastes*, March-April, 1961.

"Air Pollution Problems of the Foundry Industry." A series of reports compiled by a committee of the ferrous industries discuss the overall air pollution problem, typical foundry operations, air pollution problems of the investment casting process and instruments in techniques for measuring foundry atmospheric emissions. *Journal of the Air Pollution Control Association*, April, 1961.

• • •

Water Pumped and Sewage Treated

In Waukesha, Wisc., in 1960, water pumpage averaged 3.992 mgd while the volume of sewage treated averaged 4.963 mgd.

PUBLIC WORKS for June, 1961



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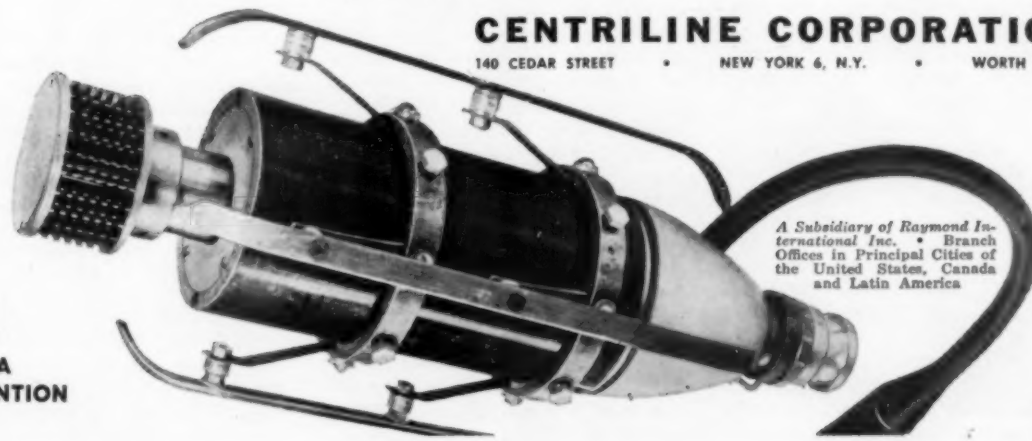
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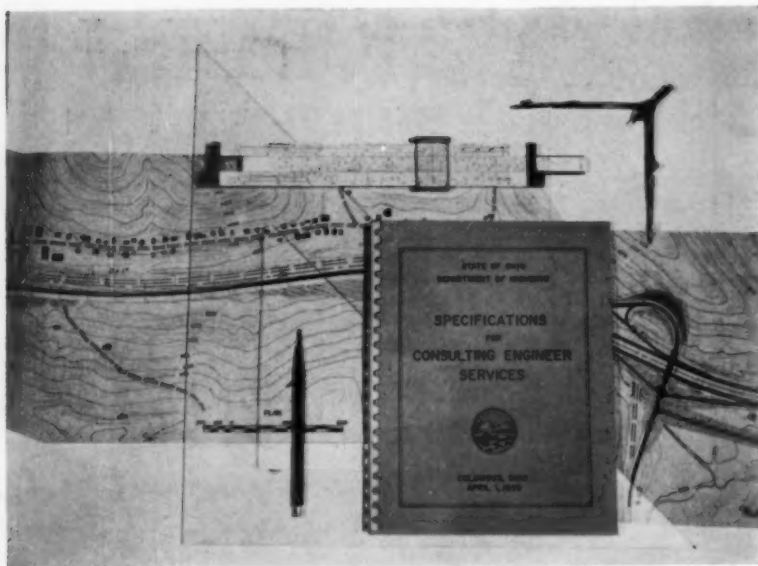
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Realistic Fee Schedules for Consultants

ROBERT WM. MEYER

Executive Assistant of Metropolitan
Expressways,
Ohio Department of Highways
Columbus, Ohio

THE ANALYSIS and evaluation of realistic fee schedules for consultants is one of the most critical facets of successful contract relationships, from the aspects of both the owner and the consultant. The generalities of this topic were presented in the October issue of *PUBLIC WORKS* under the title "Effective Contract Relations with Consultants."

It is worth while to recall two fundamentals which were emphasized in that article. The first involved the critical nature of a set of specifications, including precise definitions of terms, which permits the owner and consultant to communicate intelligently with one another without misunderstanding the exact requirements of both parties during the performance of the work. Anything less than a common comprehension of the project requirements invariably invites some degree of controversy resulting, perhaps, in valid or invalid claims for extra-work compensation.

The second, and perhaps the more important of these two fundamental

considerations is the isolation of the overall endeavor into specification categories. These work phases, properly categorized and referenced, provide several advantages; their most distinct benefit lies in the provision of an opportunity to apply different types of fee schedules to different phases of the overall work. This permits the application of a type of fee most suitable to the particular phase, type or item of work. In illustration of a particular experience pattern, I should like first to comment upon Ohio's experience for the past eighteen months under the Highway Department's Specifications for Consulting Engineer Services. Secondly, I should like to describe the impact upon Ohio's established procedures which was created by the issuance of a Bureau of Public Roads' Policy and Procedure Memorandum which dictated the application of a specific philosophy toward the development of consultant fee schedules for projects in which federal monetary participation is involved.

Ohio's Highway Specifications for Consulting Engineer Service, in addition to the first two sections on Definitions and General Clauses & Covenants, isolates the technical aspects of highway engineering work into four fundamental categories, or phases, as follows:

- Section 3 — Preliminary Engineering Report
- Section 4 — Design Report
- Section 5 — Construction Contract Plan Preparation
- Section 6 — Comprehensive Thoroughfare Report

Preliminary Engineering Report

Sub-Section 3.1 of the Ohio specifications sets forth the general purpose, requirements and objectives of a highway Preliminary Engineering Report as follows:

"The broad purpose of a Preliminary Engineering Report of this type is to provide an analysis and determination of the most feasible route locations between limits as identified in the Engineering Agreement.

"The most feasible locations shall be determined from a comparison of all the advantages and disadvantages of all alternate possibilities. The recommended location shall provide maximum traffic service at a minimum of cost as derived by the application of proper road user benefit analyses developed for each of the alternate schemes in accordance with the practice recommended by AASHO, or instructions furnished by the State. The recommended location also must be compatible with existing highway and local road facilities which may be affected by the proposed improvement and it must include appropriate consideration to existing and potential land use as related to industrial expansion, residential development, agricultural applications, major utilities, mass transportation facilities, airports and other pertinent factors. The Preliminary Engineering Report shall include adequate justification for the recommended location and it shall establish and delineate the alignment to a degree of accuracy that will permit its identification within 500 feet.

"It shall be the Consultant's obligation to provide the necessary services to achieve the aforementioned overall objectives and his obligations shall include, but not necessarily be limited to, such examples as set forth in Sections 3.2, 3.3 and 3.4 of these specifications."

Any preliminary engineering report, highway or otherwise, by its very nature is somewhat general in character and merely provides some insight into the feasibilities and comparative merits of alternative sites and design procedures. This type of report also should include comparative cost estimates for the

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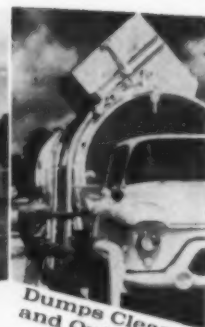
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construction and operation of all feasible alternatives, in order to provide the owner with some measure of the monetary magnitude of a project. However, cost estimates at this stage are tentative and are subject to change as the design progresses. Consequently it is not desirable to establish a consultant's fee based upon a percentage of such cost estimate. More desirable methods of fee determination are per unit of work or a cost-plus arrangement.

Where the owner has rather broad experience in the performance and cost of the contemplated work, (as is the case with Ohio's highway projects), a fee per unit of work is desirable. In highway route location work, where the magnitude or length is not known at the time of the contract negotiation, a fee per mile of accepted alignment normally is best.

Where the owner's experience is limited or non-existent, and he has no available method of determining a reasonably realistic unit fee, he may perhaps apply a cost-plus fee determination. This may be based on the consultant's actual payroll cost plus a fringe benefit factor plus a percentage (or lump sum); or better still from an audit aspect, actual payroll costs plus a slightly

higher percentage (or lump sum) to defray the consultant's cost for his employee's fringe benefits, non-productive payroll expenditures, travel and subsistence, overhead, other fixed costs, etc.

If it is assured that there will be no undue delay in entering into design with the same consultant, an owner may wish to make some type of interim payment or payments to the consultant for the preliminary engineering report work. For example, in the case where an owner does not have precise knowledge or specifications for his preliminary requirements, it may be desirable to provide assurance in the engineering agreement that the consultant will perform the contract plan work, including a preliminary report, for a specified fee. This assures the owner and the consultant, irrespective of a possible under or over payment for the preliminary work, that the final fee for the entire project is acceptable to both.

Design Report Fees

Sub-Section 4.1 of Ohio's Specifications sets forth the general purpose, requirements and objectives of a highway Design Report as follows:

"The broad purpose of a Design Report of this type is to refine the

selected route location, between given termini, and firmly establish the general design features of the proposed facility.

"A Design Report, in general, must resolve all fundamental location and design problems and delineate them in such a manner as to permit detailed construction plan preparation as a more or less routine professional procedure. Also the construction and right-of-way limits must be so delineated as to permit advance purchase of the property takings required for the ultimate construction of the facility.

"It shall be the Consultant's obligation to provide the necessary services to achieve the aforementioned general objectives and his obligations shall include, but not necessarily be limited to, such examples as set forth in Sections 4.2, 4.3, and 4.4 of these Specifications."

Any Design Report, highway or otherwise, involves the technical engineering and economic endeavor necessary to the conclusion of a project. This phase must result in the precise delineation of all total and partial property takings for the site, as well as any temporary or permanent easements; and further it must provide and delineate all of the fundamental design decisions



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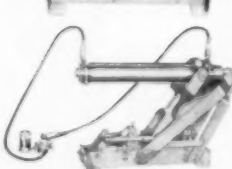
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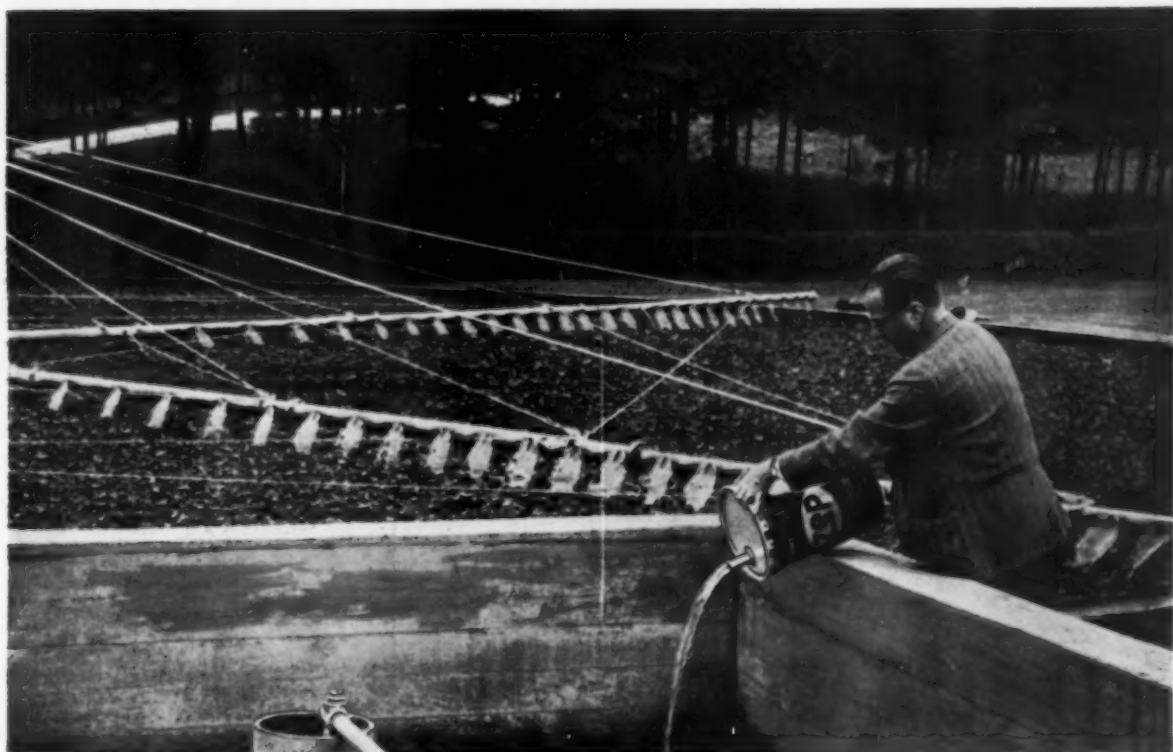
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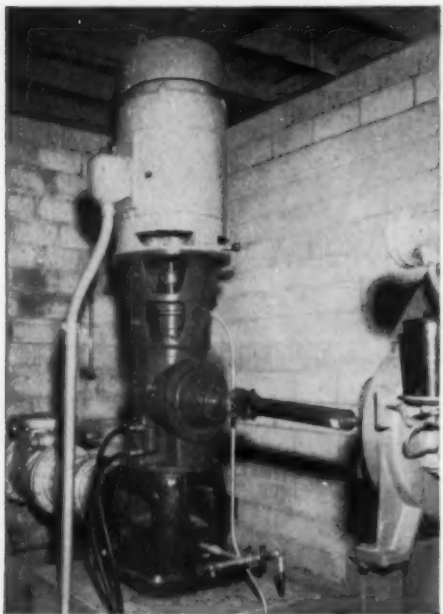
PROJECT: Veterans' Hospital, Minneapolis, Minn. **DISTRIBUTOR:** Enghausen Co., Minneapolis, Minn. **EQUIPMENT:** Truco Model B Portable Diamond Drilling Machine with 350 rpm drill motor; Truco Model S Drill Stand with 500 rpm Hand Drill Motor; Truco Tru-Vac® Vacuum Pad; Truco Diamond Drill Bits, surface set, resettable. **JOB:** Drill holes for removal of a section of 13" thick, reinforced concrete wall. Jackhammer noise proved unbearable to patients. Truco equipment did the job with practically no sound, mess or disturbance to hospital routines. Truco Drill Stand (left, above) was anchored to the wall horizontally by a Truco Tru-Vac Vacuum Pad. Truco Model B (right, above) was braced to an I beam by its telescoping center post with shaft extension. 123 holes, 3" x 3½" dia. were drilled in an average of 21 min. each: time varied with amount of reinforcing encountered. Slab weighed 8500 lbs. Savings are so great Truco equipment may pay for itself on a single job or in a single day. Write for new Truco catalog.

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which will relegate the preparation of final plans or working drawings into a more or less routine professional, semiprofessional or drafting category. Obviously the owner must be assured that a high degree of qualified talent is available for application to the design; he may well require the actual names and individual experience of key personnel who are to be assigned to the work prior to agreement with a consultant.

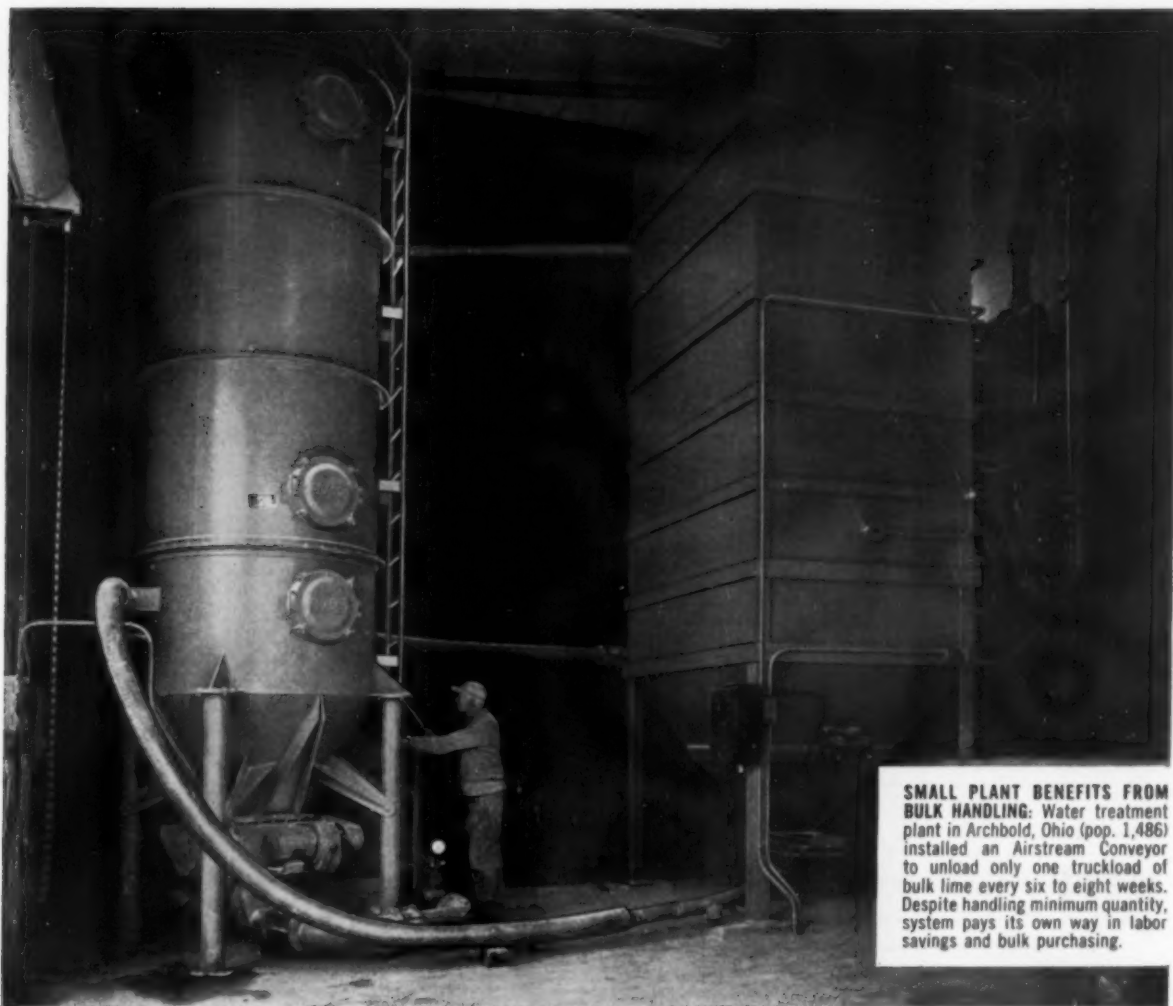
It is often desirable to require a consultant to maintain a local office for this phase of the work to permit the owner to monitor the design progress conveniently and constantly. This is especially true where detailed specifications are not available and a design pattern may deviate substantially from the owner's wishes, resulting in a valid claim for extra work to redesign certain elements to conform to the owner's requirements which were not described specifically or were overlooked at the initiation of the design contract.

Conclusion of this phase of the work results in a comprehensive Design Report including extensive narratives and design drawings which permits the inclusion, or determination by the owner, of a project cost estimate which should be fairly reliable.

A reliable project cost estimate provides a dollar value upon which a consultant's fee may be predicated, assuming that the design complexity and technical efforts are directly proportional to the cost of the project. This may or may not be true and it is primarily this ponderable which creates controversy concerning equitable fee schedules for consultants.

For example in highway work the design cost of a rock cut, as opposed to a cut in more easily removable soils, is not by any means proportional to the alternative construction excavation costs. Repetitive design element costs in some types of work and adaptations of practically identical project units to different sites may not be directly proportional to the construction, purchase or installation costs.

Circumstances conducive to a percentage fee are those in which the design effort is closely proportional to the cost of the ultimate product requiring the creative design. The fee percentage may be varied as the design complexity and volume is related to the construction cost, if such can be determined; but this requires keen judgement, is always open to other interpretations and clouds any attempt to establish what might be



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termed as a "recognized" fee percentage for similar types of projects.

There are other methods of compensation for Design Report work; but, at least in the highway industry, the fee per unit of work (as per mile) is not desirable because the degree of design complexity and volume is not equal in each unit. For example, one particular mile of a ten-mile design project may include a complex and costly directional interchange, while in the remaining nine miles, interchanges may be non-existent or of simple design. Furthermore, the design complexity and volume may be expected to be augmented or reduced while the Design Report work progresses, as a tentatively considered interchange is eliminated by new traffic data or an area of local jurisdiction demands additional access or special designs such as a depressed section.

In order to serve its purpose and objectives, the Design Report work should be of such depth and detail that the fee can be expected to represent at least one-half of the total preconstruction engineering fees.

Contract Plan Preparation Fees

Sub-Section 5.1 of Ohio's specifications sets forth the general purpose, requirements and objectives of highway Contract Plan Preparation as follows:

"The singular purpose of a construction Contract Plan is to develop and provide the State with adequate design details and related documents with which the State may receive and evaluate comparable competitive bids and subsequently enter into a construction contract with a contractor for the construction of the contemplated improvement.

"It will be the Consultant's obligation, unless otherwise indicated in the Engineering Agreement, to achieve the aforementioned overall objectives; and his obligations shall include, but not necessarily be limited to, such examples as set forth in Sections 5.2, 5.3, and 5.4 of these Specifications."

Any contract plans, highway or otherwise, provides a set of documents which will permit the owner to enter into a fabrication or construction contract for the project.

Possession of a good design report, relegates the preparation of final plans or working drawings into a more or less routine category that should seldom represent more than one half of the total cost of the preconstruction engineering. Depending upon the type of project,

it is here that the volume of lower-cost employee hours, required to convert the professional design decisions to individual detailed plan sheets with captions, notes and quantities, will govern the dollar value of the work. If a formal Design Report were not required and the consultant proceeded directly from the preliminary engineering report to contract plan preparation, this phase of the work necessarily must include all of the technical design decisions involved in a Design Report; but it would omit the actual narrative dissertations, printing, assembly and binding.

Conclusion of this phase of the work results in quantity tabulations, including all fabrication or in-place items. At this point, an extremely accurate construction estimate or contract bid cost is possible, excluding the change orders issued during

construction; and an engineering fee based upon the cost of construction may be finalized.

Prior to the negotiation of a plan preparation contract with a consultant, especially when no Design Report has been developed and the extent and the cost of the project cannot be determined within reasonable limits, a percentage type fee is appropriate. This is simply a specified contract percentage which both parties have agreed is fair and equitable. The derivation of an appropriate cost estimate for final payment is a matter of extreme importance to both contractual parties, since a fee percentage normally varies in an inverse ratio to the construction cost.

Naturally the type or method of derivation of the construction cost estimate, to which final fee payment is to be related, also must be defined

at the time of contract negotiation; and at least three fundamental possibilities exist:

1. An owner's official estimate, developed through the application to the plan quantities of average unit prices which he has found to exist during or at the conclusion of the design period.

2. An actual construction contract estimate, developed through the application to the plan quantities of the successful bidder's unit price quotations.

3. An estimate, developed through the application to the plan quantities of unit prices which were predetermined and included in the engineering agreement at the time of its execution.

The first alternative has the advantage of assuring that the construction cost estimate will reflect professional judgment and include

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actual experience averages during the Contract Plan Preparation period. The owner's estimators must be highly qualified and have access to current experience patterns and quotations at the site area.

The second alternative may be applied in cases where a sound engineering estimate is difficult or impossible to develop to the mutual satisfaction of the contractual parties. However this method has the distinct disadvantage of placing the consultant, as well as the owner, at the mercy of one or more members of the construction industry or industries involved in the project.

For example a contractor may bid a job at his cost, or less, in order to retain his trained crews for some future project.

The third alternative eliminates one variable from the cost estimate and predetermines and fixes the unit prices, leaving the plan quantities as the only unknown at the time of execution of the engineering contract. Consequently it minimizes controversies and possible claims, resulting from a cost estimate which one of the parties considers substantially at variance with what might logically have been anticipated or intended in the contract ne-

gotiation period. Consultants generally are able to estimate rather accurately the cost of doing a job and, with a profit margin included, are willing to perform the work for a certain number of anticipated dollars. If the predetermined unit prices are low, the fee percentage increases.

There is one escape for the consultant or the owner in the event that the final construction cost estimate may vary within rather broad limits, and I personally wonder why this arrangement has not been applied more often in the several engineering agreements which have come to my attention.

If a variable can be defined, such as minimum and maximum categories of cost estimates to which a particular fee applies, why not do so and eliminate subsequent controversies or inequities? This can be accomplished in the engineering agreement by associating a specific fee percentage with a final payment cost estimate. This assures both contractual parties and others that an agreed specific fee percentage shall be applied to a project cost category and eliminates within reasonable limits, the possibility that someone will suffer unduly. This is termed a "sliding" fee schedule and, applied within its inherent limitations, it may solve dilemmas in the contract negotiation period as well as the final settlement.

Summation

1. Adequate specifications for consulting engineer services, properly categorized by work phases, enables the contractual parties to comprehend each other's responsibilities and communications and further affords the opportunity to apply applicable types of fee schedules to different phases of the overall work.

2. Adequate fee schedules, for different work phases, are matters of professional discretion and deliberate consideration; they are not subject to any arbitrary rule-of-thumb or fixed rules—with each case requiring individual evaluation.

3. Fee percentages may be standardized only when construction cost derivations are standardized and design complexities are very similar.

Conclusion

It may be of interest to conclude this Article with an example of Ohio's current policy in the determination of highway construction contract plan fees for consultants, as opposed to its former policy.

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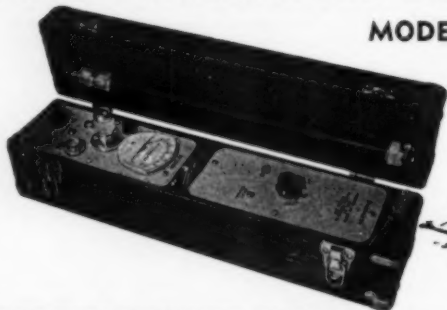
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cedure Memorandum 40-6, plan percentage fee payments were based on Ohio Department of Highways Official Construction Cost Estimates which were defined in the Specifications for Consulting Engineer Services, as follows:

"The estimate of the cost of construction of the Construction Section, as determined by the State and revealed at the time of the letting of the construction contract, upon which the Consultant shall derive subsequent Plan Percentage-Fee Payments.

"Such estimates, for the purpose of subsequent payments, shall not include costs incurred for adjustment of privately, publicly or co-operatively owned utilities for which the Consultant has not prepared plans; foundation or roadway borings; land right-of-way; property damages; construction layout staking; contingencies; construction engineering; consultant fees; industrial or other insurance when shown as a bid item; or the cost of removal of structures acquired by right-of-way purchase."

The aforementioned PPM, titled *Employment of Consultants* which governs consultant relations on all projects in which federal money is

involved in the engineering phase, under a sub-section devoted to percentage fees, states in part:

"The cost of the resultant work to which the percentage factor is to be applied is the estimated cost of doing the construction, determined by applying unit prices established by the State highway department, with the concurrence of the Bureau of Public Roads, to the proposed contract plan quantities. These unit prices should be predetermined and made a part of the consultant agreement. Provision should also be made for establishing unit prices on items not included in the agreement."

The philosophies and procedures involved in the electronic computer program development of the Ohio Tabulation of Predetermined Unit Prices, both for design reports and contract plans, is an extensive subject which is too lengthy for comprehensive treatment here.

Several fundamental problems are worthy of brief mention, such as the highway department's average and weighted average unit price experience on all highway projects—large and small. Since Ohio cannot retain a consultant on projects costing less than \$1 million, available unit price tabulations were not ap-

plicable to the "estimated cost of doing the construction" on costly projects such as Interstate segments. Consequently selective sampling of previously contracted projects was required, both rural and urban, and weighted (by quantity) unit prices in both categories were average electronically. Averages of the successful bidders' unit price quotations were selected (not the average of all bidders) as this was deemed the closest approach to a literal interpretation of the PPM items appearing in the plans.

These predetermined unit prices may or may not be representative of those applicable to the subsequent design period, and they must be updated constantly; nor do they bear any direct relationship to the engineer's cost estimate upon which fee percentage quotations were received previously.

It is too early to predict the ultimate impact of the policy change upon consultant percentage fee quotations, but it is safe to say that this change in construction cost estimate derivation procedures undoubtedly will be reflected by changes in future percentage fee proposals from consultants for highway engineering work in Ohio.

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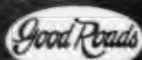
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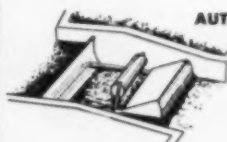
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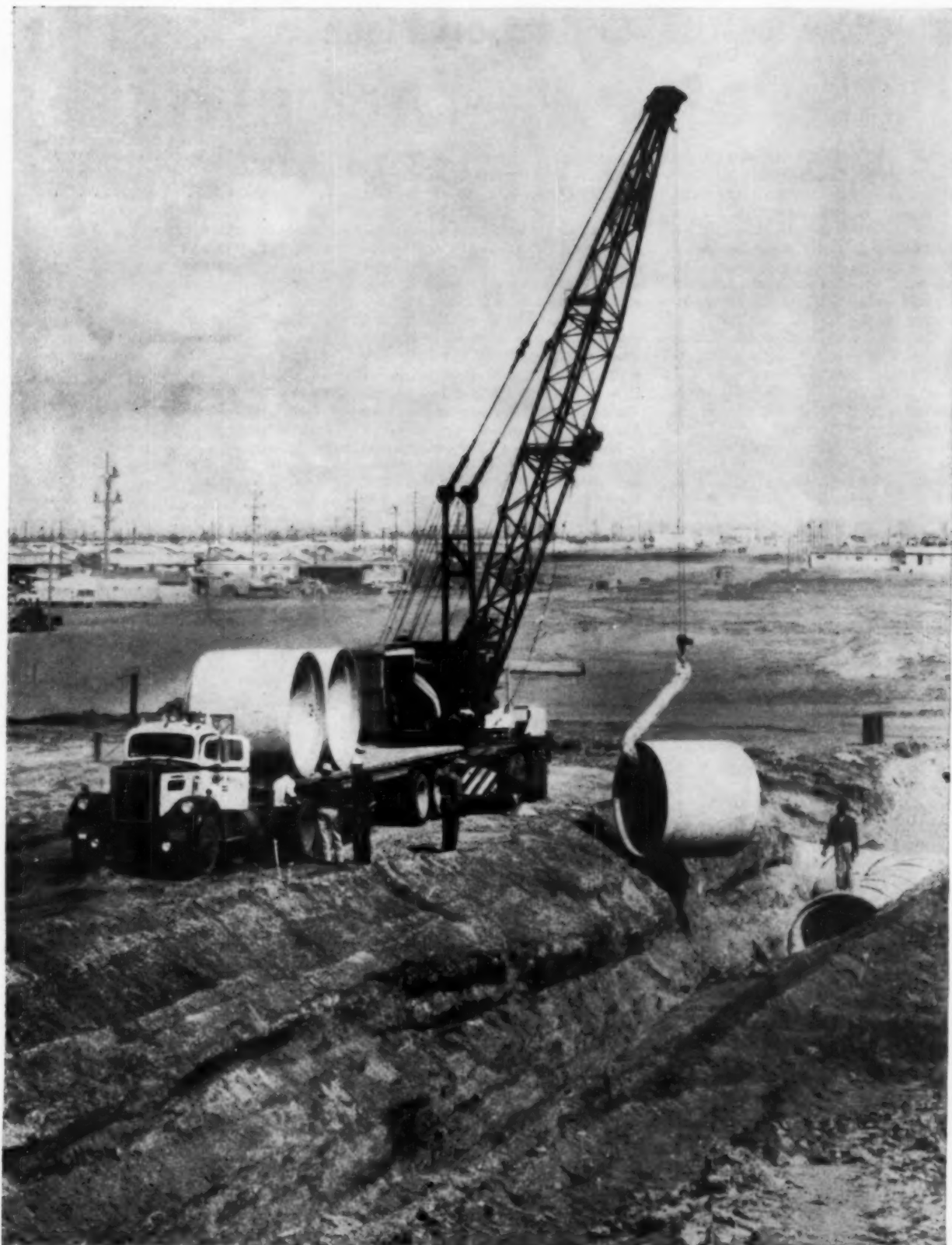


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New Refuse Collection Fleet

Saves Money for Jackson

ONE HUNDRED years ago, in 1860, the City of Jackson, Mississippi, started hauling refuse with a fleet of mule-drawn wagons. As late as 1939, the Department of Sanitation operated five open-bodied dump trucks and two mules with wagons. The area covered was 17 square miles and personnel numbered 30.

But times have changed. Today, the progressive, growing community of Jackson employs 260 people and part of their fleet of rolling stock includes 18 Hydro E-Z Packs which recently replaced the use of open trucks. The department services more than 36,000 homes and 1,600 business establishments in an area of 50 square miles, with a 1960 city census population of 144,422.

Walter E. Mixon, Jr., Superintendent of the Department of Sanitation, believes the answer to efficient refuse removal lies in the type of pickup equipment used. Jackson, like other cities, is undergoing a population explosion. In the past ten years the population has risen nearly 50 percent, with a corresponding increase in the number of refuse pickups.

With collections on the upswing, it was apparent that open body trucks would not suffice. The Sanitation Department tested compaction-type refuse collection bodies and the decision was made, in 1959, to purchase Hydro E-Z Pack refuse collection units to speed the work. Scarcely a year later, several more units were added to Jackson's fleet.

All of Jackson's packer bodies are mounted on 19,500 GVW Chevrolet trucks equipped with automatic transmissions.

Tom Marshall, City Commissioner, states: "Our Sanitation Department took over the job of increased garbage pickup almost overnight. It was a tremendous job but because of good supervision, good men and the best equipment available, we are now making over 50 percent more pickups than ever before and doing it well. Our trucks do a more thorough job, a more complete job than any other city within our area."

The city noticed the savings the day the new units began operating for all-refuse pickups. Because of their efficiency, one less man per crew was found to be required. This resulted in an annual saving of \$2,800 per truck or \$50,400 for the entire fleet of 18 units. However, both Marshall and Mixon agree that the packer type units include advantages in addition to the labor saving features. For example, capacity per unit is increased 20 percent because the bodies handle all types of refuse and compact it tighter, cutting down on the number of trips to the disposal area.

The fleet of refuse removal bodies serve in another area—public relations. Jackson residents have actually telephoned the department to compliment the city on the neat and handsome appearance of the new refuse trucks. The psychological value of this eye-appeal can best be exemplified by the attitude of

the drivers. On their own time, these busy men will wash down the trucks to keep them looking attractive. In addition, after every trip to the dump, the sump under the watertight body is drained and flushed. This sump prevents any drippings from the garbage to fall on the streets.

The department picks up more than nine million pounds of refuse every month. The trucks travel about 18,000 miles a year covering residential and commercial pickup areas. All collections are dumped into sanitary fills which will eventually support recreation and industrial sites. To date, seven of these fill sites have been completed. They range from 12 to 60 acres and depths vary from four to 30 feet.

Although the collection trucks travel some 60 miles a day, downtime is at a minimum. Jackson's 20-man maintenance department feels this is due to fewer trips to the fill area. Also, the automatic transmission equipment on the trucks is better suited to the stop-and-go driving required on a route rather than the standard clutch and shift.

Both Commissioner Marshall and Superintendent Mixon are happy with the cost-saving features of the new units; the men on the job are pleased with the good-looks and easy function of the refuse removal bodies. From the standpoint of budget, employee morale and community relations, Jackson has come a long way from the mule-and-wagon refuse collection days.



● RECORDS of the maintenance costs on the equipment are being checked by Messrs. Marshall, left, and Mixon, right.



● EACH refuse truck collects some 39,000 pounds of refuse per day; large capacity results in fewer trips to dump area.

Test Waste Stabilization Pond in Pennsylvania

In the survey on oxidation ponds and sewage lagoons published in the December, 1959, **PUBLIC WORKS**, it was noted on page 92 that the Pennsylvania Sanitary Water Board had approved the construction of a lagoon under an experimental permit. A report on a project in Allegheny Co., Pa., is published in **Public Health Reports** for March, 1961. This states that, based on temporarily established load levels of 175 persons per acre of lagoon surface area, the following observations of the pond were recorded: The minimum biochemical oxygen demand reduction through the two cells was 87 percent. Algal growth rapidly reached a maximum level of 1 million cells per ml. Hydrogen sulfide gas levels have remained at an acceptable level except on two occasions when odors could be detected only in the immediate vicinity of the pond. The reduction of coliform organisms was more than 99 percent, and preliminary studies indicate a complete removal of *Salmonella enteric* pathogens.

Although maximum loading capacities have not been reached, the lagoon method has proved feasible in the area. However, further experiments must be conducted to determine the maximum loading capacities of lagoons in this climate. Preliminary studies indicate enteric pathogens cannot survive in the full sequence of lagoon operation, but further detailed studies are needed to establish this conclusively.

...

Jamaica (W. I.) Water System To Be Expanded

A \$42 million water supply expansion program for the capital city of Kingston, Jamaica, West Indies, has been announced by the Jamaica Industrial Development Corporation. This program is calculated to take care of the needs over the next 30 years. It includes the drilling of additional deep wells at Caymanas and enlargement of the city's filtration plant at Seaview.

Meanwhile, the Jamaica government is planning with U. S. ICA assistance for the development of an island-wide integrated water supply system. The plan is being based on a survey prepared by a U. S. team of ICA consulting engineers. It calls for fifty coordinated systems to serve present and future needs of all urban and rural communities outside of the corporate area of Kingston.

PUBLIC WORKS for June, 1961



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CITY SAFETY PROGRAM

Pays Many Dividends

FRANK K. BEARDSLEE

Safety Supervisor,
Austin, Texas

THE CITY of Austin is not unlike any other industrial organization in that it has over 3,000 highly diversified employees; it is a selling (of services) agency; it employs people of all walks of life, from laborers to professional design engineers. It is not without politics, but the politicians are not within the administrative framework of production. It is similar to any other organization having a board of directors. The counterpart is our city council; the members are politicians in the sense that they are elected. The organization is governmental; it is a municipality; it is close to the people who let you know that you work for them. It therefore has to be efficiently operated and by persons who handle lethal gases, hot tar, dangerous chemicals, primary and secondary electric circuits, small hand tools, larger heavier power tools and heavy equipment ranging from forklifts to D8 dozers and power cranes. Its operations are as diversified and as dangerous as

carried out in any other organization I know of.

Do we need safety? The question has just been answered. When a company has an accident, the public sympathy is with the injured; when we have an accident, public opinion is almost entirely against the administration. We find, too, the familiar reminder that accidents cost money. On our limited budget the City can stand no accident. The hurt and suffering experienced by the injured and family weigh on our minds; we do not like to see an employee suffer or die. From these facts it can be concluded that our city and every city must have a safety program.

Our program started slowly and with a great deal of effort. Initially, it was concerned with the Electric Distribution Department only. This follows precedent in that there are few utilities without safety programs. The City started the program in Electric Distribution probably because everyone else had safety programs. This affected some 100 employees in an organization of some 1,600 to 1,700. Though less than one out of ten employees were affected, this was a start.

In 1952, management realized the acute problem of lost time and expense associated with accidents of all city employees. The safety supervisor was transferred to the centralized Personnel Department, which did deal with employees city-wide. This move put safety closer to top management.

A formal accident reporting system was instituted for all departments. By now the city had 2,000 people working for it. Needless to say, the safety supervisor had a tough task, especially in view of the request that he start a system of safety instruction. This he planned to do on a monthly basis. The response was negligible at first, but accidents became fewer, anyway. The program did take hold, however, when individual department heads became more interested—some because of the association with safety and some simply because they realized a reduction of expense and lost time. Some became interested merely because they knew that the City Manager strongly favored a safe-working organization.

As a result, much was asked of the safety supervisor. His time for meetings became less and less. With encouragement came the proposition by some department heads that they hold their own safety meetings. The request was granted. This has evolved into meetings now conducted solely under the auspices of the individual department with the safety supervisor present.

Then competition came. One department had an exemplary record. Other department heads wanted to best the record; no one yet has, but the competition created a fine show of interest throughout the city. Committees were formed of supervisors and workmen, greater circulation of NSC information was made and accident reports were modified with an eye to determine causes and corrective measures. Local and national contests were entered. Thus far the city has won approximately 30 first place prizes in TSA competition, two awards of honor and two awards of merit from the NSC. Orientation training now includes safety as one of its most important



● **RECOGNITION:** During the past three years, the City of Austin has won an Award of Honor and two Awards of Merit from the National Safety Council; also various departments of the City have won 17 separate awards from the Texas Safety Ass'n.

items of discussion. And many other things were done.

In 1955 the really great boom to the program came from the city council's decision to have every city employee covered by workmen's compensation insurance. A more rigid system of reporting and follow-up resulted, with increased interest.

A man most vitally interested in safety was assigned to the Personnel Department and workmen's compensation is handled through a secretary who also keeps records on the progress of the safety program. Safety, we feel, is still a part of personnel—since it concerns people. It is therefore part of the personnel function in the City of Austin.

Now we have more than 3,000 employees and a continuing, extensive safety program. We will put our record against any other organization's. Table 1 shows the results.

There are many conclusions and you have heard this story before: 1) Top management actively supports the safety program; 2) safety meetings conducted by departments themselves encourage individual realization that the employee is important—he thus becomes safety minded; 3) publicity of the program indicates safety is a vitally important concern of the organization; 4) accurate and prompt reporting enables departments to have a spirit of competition. There is an incidental derivative and a very important one; the employee is proud of his City and his department.

The program has run into problems as any program will where 3,000 workers are involved. 1) As a governmental agency we are limited to choosing one doctor to care for all medical cases. 2) Employees sometimes are slow in reporting what they think are minor accidents—infections, hernias and back sprains give us trouble. 3) Some supervisors are so overloaded with work that their "span of control" does not permit them to look thoroughly into each accident cause. 4) We have encountered rather high medical bills. 5) Some safety meetings drift off into other areas of discussion and the safety supervisor must steer them back on course. 6) The shortage of safety division personnel limits participation in other than daytime shifts.

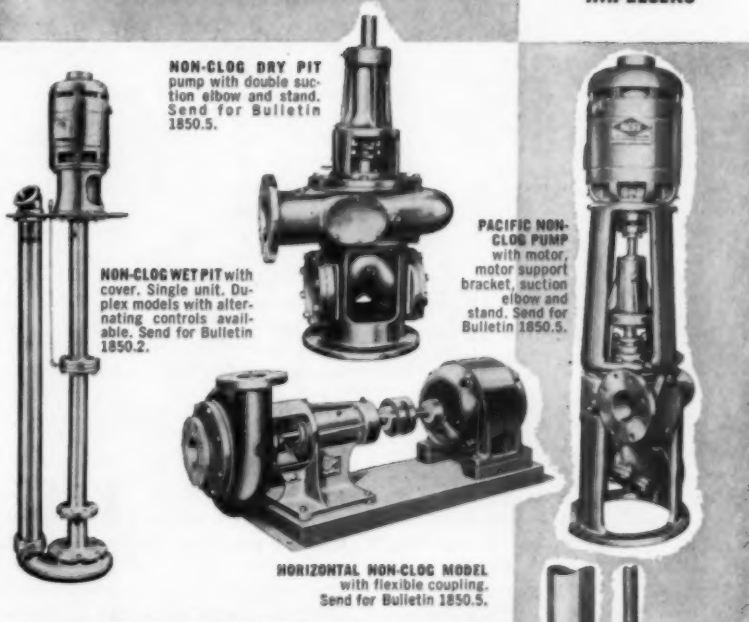
But these are minor. We are convinced the program has paid off tenfold the amount invested in it. We would like to add an additional professional safety man but a limited City budget will not allow this. We are sold on safety and on our program.

Table 1—Accident Record for 8 Years of Safety Work

Year	Lost Time Accidents	Days Lost	Frequency	Severity
1952	87	6575	31.72	2400
1953	114	6871	20.67	1246
1954	83	988	14.55	173
1955	62	677	11.38	124
1956	54	1464	9.47	257
1957	54	1156	8.82	189
1958	39	388	6.03	60
1959	54	1350	7.72	193

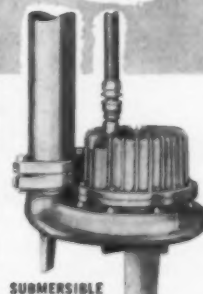
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Pesticides, Chemicals and Water Pollution

CLARENCE COTTAM

Director,
Welder Wildlife Foundation,
Sinton, Texas

This article is based on a paper presented at the National Conference on Water Pollution in Washington, D. C., in December, 1960.

MORE than half a million organic chemicals have been made and described. A few dozen of them are accepted by the Food and Drug Administration as being safe for addition to food and beverages and many are listed with a zero or near zero tolerance level for human consumption. New materials or compounds are being made much faster than the toxicity of known materials is being studied.

Most surface waters receive a large, variable and anonymous load of organic chemicals. Only a minute fraction of the materials dumped or washed into surface waters could hope to qualify with the Food and Drug Administration as acceptable for addition to food and beverages. These pollutants are altering and adversely affecting the environment in which our people must live. Pesticides form an ever increasing part of this complex chemical picture.

Since World War II, the pesticide chemical industry has undergone a revolution. The principal insecticides used before the War were either inorganic compounds such as the arsenicals or the naturally occurring poisons like pyrethrum, rotenone and nicotine. Copper sulfate, arsenic compounds and related poisons were the principal herbicides used. The introduction of DDT and 2,4-D, in about 1943 to 1945, marked the beginning of a tremendous upsurge in the development of what is now a bewildering array of chemical pesticides. More than 90,000 pesticide products and formulations are now registered under the Federal Insecticide, Fungicide and Rodenticide Act.

Entomologists predict, and chemical manufacturers hope for, a four-fold expansion in use of pesticides during the next ten to fifteen years. Today, over 12,500 brandname formulations and more than 200 basic control compounds are on the market. Most of the currently used pesticides were unknown even ten years ago. Furthermore, and con-

trary to the public interest, most new pesticides are decidedly more toxic, generally more stable and less specific in effect than those of but a few years back.

We do not know the total production or consumption of all pesticides. The Commodity Stabilization Service of USDA shows that 287,000 tons of only 15 major chemical pesticides were produced in the US in 1958. In addition, imports amounted to some 2,801,572 lbs. of synthetic pesticides, 2,545,565 lbs. of organic phosphorus insecticides, 4,706,246 lbs. of pyrethrum flowers, 355,732 lbs. of extract pyrethrum, 1,816,300 lbs. of ryonia and \$729,189 worth of rotenone root. In addition, some 93,160,000 lbs. of zinc were used in the production of fungicides; 28,346,000 lbs. of pentachlorophenol were used as a wood preservative. Most chemical solvents for pesticide formulations are poisonous and, therefore, should be considered in the total picture of poisons used. In 1958, some 25 to 30 million gallons of these chemicals were used in pesticide formulations.

Currently, nearly one-fifth of our croplands and millions of acres of forest and rangelands are treated from one to seven or eight times each year with the same or different pesticides in quantities of a few ounces to more than 20 lbs. per acre.

Do These Chemicals Become Pollutants?

There is abundant proof that there often are immediate ill effects upon wildlife resulting from many of the eradication and control programs and that the soil is polluted with some of these toxicants for many years. There also is considerable evidence of serious side effects that are generally overlooked because of delayed action. The only reason for using any pesticide is that it is toxic to something. Some of these poisons are not very toxic to man while others are among the most toxic materials known. There is much evidence that some of these chemical poisons are getting into our water systems. In some areas, where the chemical concentration of poisonous pollutants has been high, there has been considerable loss of wildlife resources. The more subtle, indirect and long range effects of these toxicants upon man and his wildlife resources are not known but they could be profoundly important.

Dr. Woodward of the Public Health Service has warned that: "In general, these chemicals are undesirable additions to water and every effort should be made to keep their concentration not only below the threshold of any toxic effects but also as low as is reasonably possible."

Pesticides and Water

Pesticide compounds may enter our water supply through direct application to the water surface, by drifting on to the water surface from adjoining treated areas, or by being washed in from the watershed.

When large amounts of stable chemical poisons are broadcast over extensive acreages, it is virtually certain that some will get into our public water supplies. It is well known that they are not readily detected in water. ABS (alkyl benzene sulfonate), a common constituent of synthetic detergents has been found in streams at concentrations sufficient to kill fish, and in ground water in concentrations even exceeding those found in surface waters. Studies are needed to determine the presence of pesticides in ground and surface water, especially in areas of heavy use. More practical, economical and effective means of removing them are needed.

Pesticides already have been found in the major U. S. rivers. DDT has been noted in concentrations in the range of 1 to 20 ppb in the Mississippi at Quincy, Ill., and at New Orleans; in the Missouri at Kansas City; in the Columbia at Bonneville Dam; and in Lake St. Clair and the Detroit River. Aldrin was found in the Snake River at Pullman, Wash. at 1 ppb.

Fish Kills

As a means of detecting pollution problems in streams throughout the country, the U. S. Public Health Service, under the leadership of James Harlan, and with the cooperation of state conservation departments, state health departments and water pollution control agencies, initiated a national survey of fish kills. In the returns from 28 states, covering the four months from June through September more than 200 reports of individual kills were recorded. The number of fish lost varied tremendously in the different instances of poisoning from "a few" to "five million." In the majority of

the cases the extent of loss was not recorded specifically.

The highest losses were caused by pesticides, 38 percent; industrial pollution, 27.7 percent; domestic sewage, 7.7 percent; mining wastes, 3 percent; miscellaneous or other causes, 9.7 percent; and unknown or undetermined, 13.9 percent. Because of the difficulty in identifying kills by pesticide poisoning and the relative ease of tracing losses caused by industrial and mine wastes and domestic sewage, it seems possible that a goodly portion of the unknown causes may have resulted from the use of pesticides.

Pesticide Toxicity

While many chlorinated hydrocarbon pesticides were listed as being the cause of the fish kills, endrin seemed to have been the one most commonly listed. This is not surprising in view of the fact it is the most lethal pesticide to fish yet developed. Because of its high toxicity, it also is commonly used as a rodenticide and surprisingly too as a toxicant on vegetables. Like most chlorinated hydrocarbons, it is a broad spectrum, stable, highly toxic poison. A concentration of 0.6 ppb will kill 50 percent of test bluegills in a period of 96 hours. This concentration would require only 0.005 pound of endrin in one acre of water three feet deep. By continuous exposure for 20 days, much less than this amount would be lethal. Tarzwell, Henderson et al. and DeWitt have demonstrated the high toxicity of the newer pesticides. Toxicity of the ten most commonly used chlorinated hydrocarbons to fish, in descending order, is as follows: Endrin, toxaphene, dieldrin, aldrin, DDT, heptachlor, chlordane, methoxychlor, lindane and BHC. There is some variation in the order of the effects these chemicals have upon birds and rodents, but BHC and methoxychlor are generally the least toxic to this group. Shrimp and other related invertebrates are highly susceptible to pesticides.

Of the less stable organic phosphorus compounds guthion is by far the most toxic to fish and it ranks close in toxicity to toxaphene. This group of poisons varies greatly in toxicity with the various species of fish, but most of them hydrolize quickly and generally are not highly toxic after 24 to 96 hours.

That the runoff from treated areas can be toxic to fish has been demonstrated many times. Tarzwell sampled the runoff from a small area treated with dieldrin at the rate of 4.6 pounds per acre and found that

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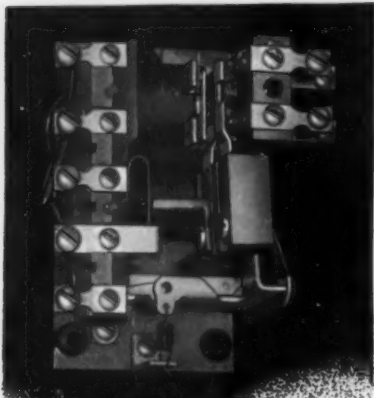
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it was toxic to fish in a dilution of 1 to 3. A sample of water from an orchard area in Pennsylvania was found to be lethal to fish in four hours. One pound of dieldrin per acre on a 20,000-acre tract in St. Lucia County, Florida, used to control sand flies, killed 20 to 30 tons of fish.

Young and Nicholson found that there was a serious valley-wide (TVA) fish kill in 15 streams in eight counties of northern Alabama in 1950, caused by heavy use of toxaphene, DDT, BHC and aldrin to control the cotton boll weevil. Some 26 million pounds of these pesticides were used during that summer. Heavy rains washed the toxicants into the streams and excessive fish loss resulted in all streams studied.

Forest Sprays and Fish

Spraying extensive forest areas against spruce budworm in the watershed of the Miramichi River in New Brunswick in 1956, at the rate of one-half pound of DDT per acre, produced a 91 percent kill of young salmon. In June, 1958, some 302,000 acres of northern Maine forest were sprayed with DDT at the rate of one pound per acre to control spruce budworms. Loss of trout was moderately heavy; young of the year comprised 30 percent of the loss. Trout collected three months after spraying contained from 2.9 to 198 mg/L DDT. A significant growth decrease was noted in trout in sprayed areas a year following spraying. The population of brook trout was reduced considerably. Similar experiences were noted in Vancouver Island, B. C., and in Montana.

Ground Water Contamination

With the amount of chemicals being used, including pesticides and detergents, it seems inevitable that some of these materials ultimately would enter our water courses and even penetrate into the underground aquifers. A number of examples already are on record.

Montebello, Calif.

In June 1945, a small plant in Alhambra, California began manufacturing 2,4-D. A batch of the raw material failed to react properly and the chemicals were discharged to a sewer. Thence, this waste entered the Alhambra pumping station, passed through the Tri-Cities activated sludge sewage treatment plant and was discharged into a mile-long ditch. From here the contaminant traveled some three to five miles above ground, then seeped into the underground strata from which

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Montebello, a city of about 25,000 population, obtained its water supply. Within 17 days, taste and odor of unreacted 2,4-D (dichlorophenol) was noticed in the eleven wells supplying the city. The operation of the plant was stopped within 30 days, yet the taste and odor of dichlorophenol persisted for four to five years. This case is interesting and important because it shows the possible long time effects from wastes even though they were unwisely discharged over a relatively short period.

South Platte River Basin

This represents another significant case in the serious pollution of underground water. In 1943, the Rocky Mt. Arsenal of the Chemical Corps, located near Denver, started to manufacture warfare agents. In 1955, it was leased to an oil company which has used the plant to manufacture insecticides.

It seems probable that sludge from the pond used at the Arsenal by the Chemical Corps between 1943 and 1955, to hold chemical waste effluents is the source of the contamination. Phytotoxic substances in this waste included chlorates and phosphonates. It appears that other waste substances in the discharge in the presence of air, water and sunlight caused these waste materials to combine and form 2,4-D. There is no evidence to indicate that 2,4-D had been purposely manufactured at the Arsenal. We must assume, therefore, that the 2,4-D was synthesized in the waste mixture from precursors introduced from the plant operation. There may also be other contaminants.

Farm crops were first affected in 1951. It apparently took seven to eight years for the contaminated water to travel approximately three miles. By 1958, contaminated water extended over an area of several square miles and seriously affected crop production, industry and the people who had relied on the water for their own culinary purposes and for livestock. At least one case of illness has been shown to have been caused by drinking this polluted water. How long this pollution by poisons will last and what total damage yet will result is unknown, but obviously it will be many years before the damage is corrected. Many shallow and some deep wells occur within this basin, and approximately 150 residences are within the known or suspected area of contaminated shallow ground water.

Because ABS is not found in any natural substance, its presence in

water is evidence of contamination. Pollution containing ABS in ground water may come from seepage from cesspools and absorption fields, oxidation ponds, natural and induced infiltration from streams or channels receiving sewage, holding ponds for industrial and commercial wastes and facilities for waste disposal from commercial laundries.

Housing developments wherein each dwelling is serviced by its individual well and sewage disposal system often invite pollution. Walton points out that 35 percent of 600 well waters analyzed from Suffolk County, Long Island, New York, contained ABS, and it is estimated that there are, or soon will be, some 17,000 ABS-contaminated wells in that county. A survey of 54,000 private well waters in the vicinity of Minneapolis and St. Paul showed about 50 percent such pollution. Studies from 976 well waters in 13 states showed that 36.6 percent of these contained ABS.

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• • •

Water Use in Tucson

Average water consumption, based on 43,157 services and 4.25 persons per service, was 156.9 gpcd. Maximum day use was 340 gals. per person, and minimum use 62 gpcd. The number of persons per service was based on the returns of the 1950 census.

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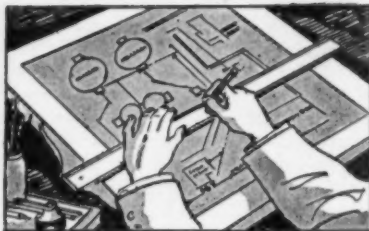
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PL 660 in New Mexico
(Continued from page 134)

summer the local race track attracts crowds up to 15,000 to 20,000. How do you finance a sewage collection system and a treatment plant to handle 15,000 to 20,000 people, with only 1200 permanent residents? Most of the houses are built on rock outcropping, so cesspools and septic tanks were almost useless. In practically all instances they simply overflowed into the creek which had become practically a raw sewage canal; yet the children played in it all summer. Finally, financing was arranged and a plant built that will work with the low winter-time population and still handle the heavy summertime loads. The sewage collection system was quite expensive to construct due to the rock, but a fairly comprehensive system has been built. The Rio Ruidoso is again becoming a fit place for the children to play in, and the complaints have all died out. The total estimated cost of the job was \$623,982 including a Federal contribution of about \$117,624. Construction was completed in June, 1960. Like Grants, this was one of our more serious problems and it could never have been solved without the use of Federal funds.

Result of the Program

As of this writing, New Mexico has built, or is building, 51 projects, all of which have been made possible by the construction grants funds of Public Law 660. There are 68 sewer municipalities in the state, and we have 66 new or renovated plants. Our major water pollution problems caused by the discharge of municipal sewage have for the most part been solved. We have enough improvement projects lined up to take care of next year's allocation. After that, we may not be able to use our total allotment of funds each year.

In the beginning of this article, the shortage of water in New Mexico was stressed. By cleaning up our pollution problems we are conserving our surface water supplies to permit multiple use. A great deal of the success of our program in selling sewage treatment works in New Mexico can be attributed to our being a water-short state. Our municipal officials know the value of water and are receptive to recommendations for treating it for re-use downstream.

Because our water and sewage treatment plants have become more complex, it has become necessary

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for our municipalities to employ more highly qualified personnel than was formerly the case. It also became apparent that a training school was necessary. As a result, a meeting was held at New Mexico State University in 1956 to organize a formal association. Personnel from the State Health Department contacted water superintendents and sewage plant operators all over the state. We felt we would be lucky if fifty or sixty people showed up at the meeting. Imagine our surprise when the attendance climbed to 107. The group was very enthusiastic and a three-day school was held. By the end of the meeting the group had organized themselves into the New Mexico Water and Sewage Works Association.

Various plans of certification were studied, and in May, 1958 a voluntary certification plan for water and sewage works personnel was officially adopted. Today there are five sections in the association, which meet monthly to study the Texas Manuals on water and sewage. There are about 260 paying members in the organization, most of whom have qualified for Grade C Certificates, while many have their Grade B Certificates. This year Grade A examinations will be given for the first time. Our water and sewage works people are very appreciative of the school, and the monthly meetings. They feel they are receiving good training and we can already see a difference in the way they operate their facilities. With our limited personnel, we could not possibly train all of these people individually, but in a three-day school with the faculty of State University available to us, we can really help our water and sewage works operators.

The association is an indirect benefit of Public Law 660, which has resulted in so much construction and the employment of so many younger and more interested men. We hope Public Law 660 will be continued. It has certainly helped us and will continue to help until all of our problems relating to water pollution control have been resolved.

• • •

Cost of Garbage Collection

The unit cost of collecting garbage in Waukesha, Wisc., in 1960 was 12.1 cents, based on a total of 445,192 collections and a cost of \$53,806.80. The cost per cubic yard was \$3.76. The average collection weighed 14 lbs. and the average per capita production for the year was 214 lbs.

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PUBLIC WORKS EQUIPMENT NEWS

Hydraulic Dozers



An hydraulic system for all blades used on the Euclid Model C-6 tractor consists of a single cylinder and a variable volume pistol pump known as the Gar Wood Variacs. The Variacs pump delivers oil only when needed for raising and lowering the blade. When the blade load exceeds system capacity, the Variacs pump stops delivery of oil and automatically goes into hold position. In addition to fast blade speed,

lifting power of this single cylinder design is up to 7 tons greater than normal dual cylinder dozer mountings because of greater mechanical advantage of the lever arm. Controls are easily operated, positioned for convenience power actuated and without mechanical linkage.

Euclid Division of General Motors, Hudson, Ohio.

Circle No. 6-1 on the convenient reply card facing page 34.

Aquatic Herbicide

A pelletized herbicide, Chem Pels 2, 4-D, for the chemical control of submerged and emergent broadleaf weeds, has been developed in an insoluble ester form for slow, regulated toxicant release of ingredients to the plant intake structure. The granules are not affected by water dilution, depth or flow and provide effective residual lethal concentrations for periods of one to three years. They are non-toxic to humans, animals, fish or aquatic organisms and produce a slow killing action to broadleaf weeds; thereby gradually reducing oxygen and the possibility of any fish kills.

Chemical Insecticide Corp., 30 Whitman Ave., Metuchen, N.J.

Circle No. 6-2 on the convenient reply card facing page 34.

BEFORE



AFTER



Treatment provides weed-free water.

Coated Coupling

Dresser's "Stab-Clad" Style 123 coupling has a permanent coating which will not disbond in any weather. This coating has the unusual feature of being concealed by a useful but expendable outer shell, while independently assuring 99.2% protection against corrosion-causing holidays. Electrical continuity of the coupling, achieved through a special bonding device, assures cathodic protection against corrosion.

Dresser Mfg. Div., Dresser Industries, Inc., Bradford, Pa.

Circle No. 6-3 on the convenient reply card facing page 34.



Permanent coating offers protection.

Delineator

A highway delineator that provides high reflectivity, even in fog, mist and high moisture conditions, has been put on the market. Extensive tests have established its brilliance under favorable and adverse weather conditions, and its high visibility even when mounted at extreme mis-alignment. The product is available in a standard rectangular shape, approximately 3½ by 7¾ inches. It can be made in virtually any shape to meet design requirements.

Prismo Safety Corp., Huntingdon, Pa.

Circle No. 6-4 on the convenient reply card facing page 34.



Hi-Lift Hoist

This Perfection Hi-Lift hoist and special platform body provides convenience to workmen on bridge maintenance, especially in bridge painting and preservation. With the hoist, men and materials on the platform can be raised any height from truck chassis level to over 12 ft. from the ground. Raising and lowering of the platform is hydraulically controlled from the truck cab and/or body. The wide and long platform area gives the workmen sure footing and permits raising and handling large quantities of needed materials without the usual hand-passing encountered in ordinary methods of maintenance.

Perfection Steel Body Company of Galion, Ohio.

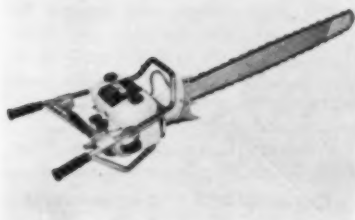
Circle No. 6-5 on the convenient reply card facing page 34.

Chain Saw

Combustion chamber design, efficient carburetion, fast starting and ease of operation are the main features of these professional chain saws. The McCulloch One/92, a chain saw of the swivel transmission type, is easily adapted as the power unit for the McCulloch earth drill attachment.

McCulloch Corp., 6101 West Century Blvd., Los Angeles 45, Calif.

Circle No. 6-6 on the convenient reply card facing page 34.



Air Sweeper

Blow-Vac, an air sweeper, replaces hand sweeping by exhausting air at hurricane force with its 6-bladed aluminum-magnesium impeller with special air cupping on the blade tip. The standard model has a 3¼-hp engine and sleeve-recoil starter with remote throttle controls on the handle bars. Blast outlet is adjustable to any angle, forward, down and back. A six-inch hose can be attached to outlet to direct the air blast into confined



areas; or it can be attached to the blower inlet for suction pickup of almost any kind of material.

Outdoor Vacuum Div., Wheel Trueing Brake Shoe Co., 628 Baltimore, Detroit 2, Mich.

Circle No. 6-7 on the convenient reply card facing page 34.

Bacterial Sampler

The No. 1422 bacterial bottom sampler, is used to obtain undisturbed sediment samples for bacteriological investigations, particularly of pollutants near sewage outfalls. The instrument is ruggedly constructed and easy to use. Upon contact with the bottom, a plate uncovers a sterile vial allowing material to enter. It then snaps forward cutting off a slice of the bottom which remains trapped in the vial. The contents are used for coliform or other studies. Samples may be taken at any depths and in any type of water.

Kahl Scientific Instrument Corp., P.O. Box 1166, El Cajon (San Diego), Calif.

Circle No. 6-8 on the convenient reply card facing page 34.



Tandem Tanker

An accessory for the Wald Model 16 reflecto-liner, the tandem tanker, makes it possible for owners of the unit to convert easily to a two-color operation to meet two-color marking standards, or to double the paint capacity for a two-gun single color operation. The tanker will also attach to the Wald Model 12 machine. The Tandem Tanker also serves as a compact trailer, with a comfortable seat for the operator.

Wald Industries, Inc., of Huntingdon, Pa.

Circle No. 6-9 on the convenient reply card facing page 34.

Pneumatic Roller

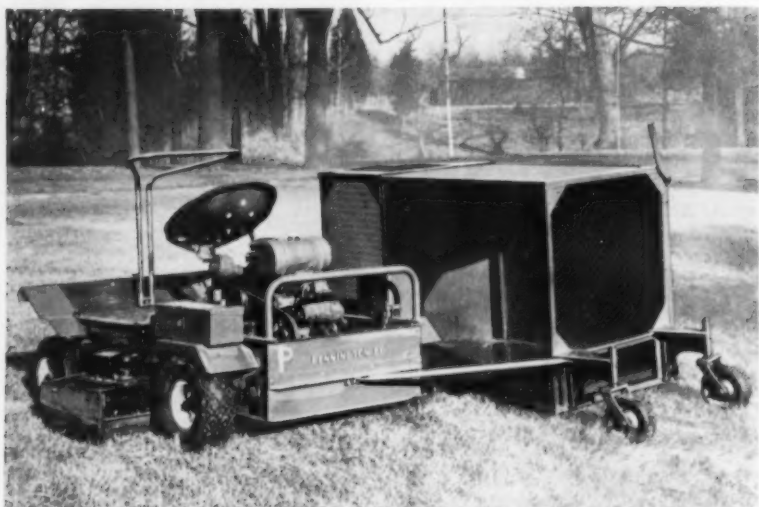
The Littleford Model 9S-14 self-propelled pneumatic roller is designed to give the user a roller with arrangement of the tires and wheels in proportion to the weight they carry, equal load distribution per wheel and recognition of special trends in compaction to higher wheel loads and inflation pressures.

Littleford Bros., Inc., 457 East Pearl St., Cincinnati 2, Ohio

Circle No. 6-10 on the convenient reply card facing page 34.



Litter Sweeper



This leaf and litter sweeper attachment for riding mowers is aimed at fulfilling the needs of park, municipal, industrial and military installations, and many other commercial uses. The sweeper attachment picks up leaves (even wet leaves), paper, cardboard cups and plates, twigs, clippings and other trash, and blows the material into

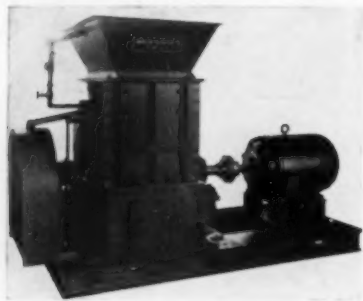
a hopper cart. Brush holders, placed on mower spindles in place of mower blades, are equipped with special air fins to provide the necessary lifting and blowing action to pick up material.

Pennington Manufacturing Company, Addison, Illinois.

Circle No. 6-11 on the convenient reply card facing page 34.

Garbage Grinder

A grinder that will reduce 20 tons of garbage per hour, the GG series, is designed primarily for municipalities with large-scale garbage disposal operations. It is furnished in three sizes for capacities of 5, 10 and 20 tons per hour. A water feed line is made a part of the grinder where the garbage is to be flushed into sewers. Where the conveyor feeds the grinder, the use of a magnet above the conveyor line is recommended to serve as first-step metal remover. Any metal that feeds into the grinder is "kicked" into a metal trap alongside the crushing chamber where it can be easily



removed. Reduction is by shredder-type swing hammers.

American Pulverizer Co., 1249 Macklind Ave., St. Louis 20, Mo.

Circle No. 6-12 on the convenient reply card facing page 34.

Soil-Cement Test

Equipment for conducting flexural strength tests of soil-cement specimens is designed for engineering testing, research and educational laboratories. The flexural test molds, model CT-409, are produced in accordance with the ASTM designation D-1632. This test covers the making and curing of soil-cement compression and flexural test specimens in the laboratory. The flexural strength attachment, model CT-407, is available for determination of flexural strength of soil-cement by use of a simple beam with the third point loading method. This procedure is covered by ASTM designation D-1635.

Soiltest Inc., 4711 W. North Ave., Chicago 39, Ill.

Circle No. 6-13 on the convenient reply card facing page 34.

Telemeter

This all-electronic telemetering system offers cycles of 2 seconds and less. The standard 2-second cycle provides high scanning speed and more sensitivity to rapidly fluctuating measurements. Unlike the electro-mechanical type, the electronic system has few moving parts, no mechanical cam followers, no clutches and no mercury switches. The transmitter features a photo-diode detector which scans input position in relation to a cam etched on glass and operates sealed dry switch contacts in the transmission system. The receiver has convenient plug-in components, transistorized amplifier and powerful servomotor; and is insensitive to supply frequency changes.

The Foxboro Co., Foxboro, Mass.

Circle No. 6-14 on the convenient reply card facing page 34.

Floating Intake

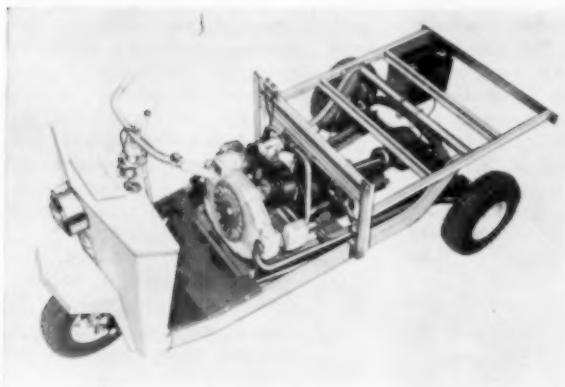


The Precision pump-tank combination, with a floating intake assembly at no extra charge, provides a covered solution tank which protects the cleanliness of the pumped solution and serves as a pump stand, making wall brackets or separate stands unnecessary. The floating intake assembly floats the chemical pump foot valve just below the surface of the solution to avoid floating particles, and keeps it off the bottom of the tank to avoid accumulated sludge which may foul valves and solution lines.

Precision Chemical Pump Corp., 1396 Main St., Waltham 54, Mass.

Circle No. 6-15 on the convenient reply card facing page 34.

Utility Vehicles



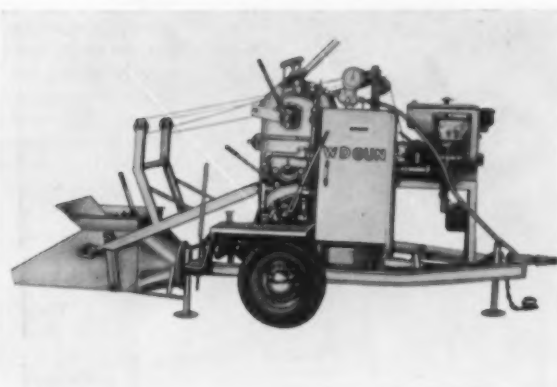
This line of gasoline and electric-powered Cushman Trucksters features a greater range of power—up to twice the horsepower of previous units—and more versatility through the modification of existing, and the addition of new, body styles. The gasoline-powered 780 series Trucksters have extensive internal changes in the form of power plants and mechanical modifications. The engines give the vehicles up to twice the power of last year's 7.95-hp Husky engine and qualify the Truckster as a faster and more powerful vehicle for delivery ser-

vice, vending, parking meter patrolling and other on-the-street applications. The engines, the single-cylinder 9-hp OMC Super Husky and the two-cylinder 18-hp OMC Twin Super Husky, are die-cast aluminum for light weight and faster cooling and feature overhead valves, a full pressure lubrication system, 4-cycle operation and an alternator rather than a generator.

Cushman Motors, Subsidiary of Outboard Marine Corp., 1027 N. 21st St., Lincoln, Neb.

Circle No. 6-16 on the convenient reply card facing page 34.

Concrete Gun



Airplaco's WD Gun features the Roto-Rol Mixer in top pressure vessel to assure continuous operation. Augermatic feed provides flow control with a continuous feed from a single outlet for smooth, uninterrupted flow of material, wet or dry. A unique skip loader screens sand and cement into separate compartments and is operated with simple foot pedal control. The WD gun also features a built-in water meter, variable feed control and large 15-in. fill door with self-cleaning, self-sealing slide valve. Production rates for gunning are 4 to 8 cu. yds. per hour.

Air Placement Equipment Company, 1012A West 25th St., Kansas City 8, Mo.

Circle No. 6-19 on the convenient reply card facing page 34.

Hot Sprayer



A completely self-contained hot spray unit, the Chieftain series II, provides a full range of temperature control for one or two guns and for hose line lengths from 10 to 60 ft. The Chieftain maintains a uniform selected temperature control at the gun, producing a two-coat requirement with a single spraying pass. The unit is available in fixed

or mobile models and is designed for use in spray booths, spray areas, or for field maintenance work.

The Spee-Flo Co., 6614 Harrisburg Blvd., Houston 11, Texas.

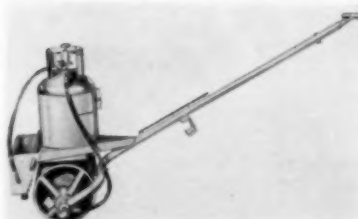
Circle No. 6-17 on the convenient reply card facing page 34.

Heated Roller

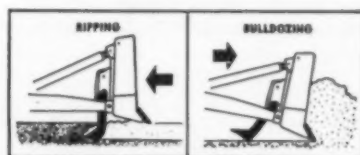
The Hotroll, a 335-lb. heated asphalt roller, is said to provide compaction equal to a 5-ton tandem. Hauling on the tail gate of the truck and a four-torch pre-heater make cold patching easy. The unit will roll flush to walls, curbs and abutments.

Douglas Motors Corp., 1234 No. 62nd St., Milwaukee 13, Wis.

Circle No. 6-18 on the convenient reply card facing page 34.



Back Ripper

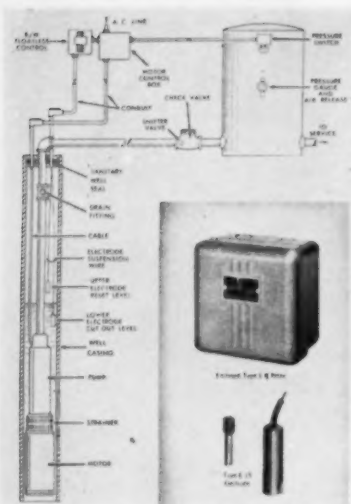


Preco black rippers are now available for installation on International tractors. Mounting directly on the rear of the dozer, the rippers give two-way dozer production, forward and reverse, increasing tractor efficiency by putting the backup trip to work. A valuable attachment contributing materially to increased scraper production as well as dozing, the rippers continue to be available through Caterpillar Tractor Co. dealers for their models.

Preco, Inc., 6300 E. Slauson Ave., Los Angeles 22, Calif.

Circle No. 6-20 on the convenient reply card facing page 34.

Level Control



A submersible pump control for automatic low water cutoff protection and full capacity pump operation, this floatless liquid level control system consists of a standard B/W Type LH induction relay with

two type E-IS insulated electrodes suspended at desired levels in the well. On a submersible pump installation, the lower electrode is normally set down in the well, just above the pump. When the water level in the well is pumped down to where the lower electrode is uncovered, the pump is automatically stopped. When the water level in the well builds up to the upper electrode level, the pump is automatically started, providing the pressure switch still requires water to flow into the tank.

The B/W Controller Corp., 2200 E. Maple Rd., Birmingham, Mich.

Circle No. 6-21 on the convenient reply card facing page 34.

Infrared Detector

The Eagle "I" vehicle counting detector is an active type detector which produces its own modulated source of infrared energy and detects the reflection of that energy as vehicles pass through its 1½

x 6-ft. curtain of radiation across the vehicle lane. The curtain cross-section, though invisible, detects within an area equivalent to the well known pressure detector, thus eliminating possibility of cars passing around the side of the detected area. The unit is comparatively simple and maintenance free. The count detector and its components (except for the two projector source lights, available at any photographic supply store) are guaranteed.

Eagle Signal Co., Div. of The Gamewell Co., 202-20th St., Moline, Ill.

Circle No. 6-23 on the convenient reply card facing page 34.

Tree Faller



This equipment offers a lowcost method for removal of problem trees. It permits safe control of the direction of fall of heavily-leaning trees that threaten buildings, power and telephone lines, or other improvements. Trott's directional tree faller is a useful tool for recreational improvements, park maintenance, right-of-way clearing and other situations where time or damage could be saved by accurately controlling direction of fall of problem trees. Available for use with the Tree Faller is an accessory called the pole straightener. It can be employed quickly and easily to straighten utility or other leaning poles where the earth has softened. Idaho Northwoods Co., P.O. Drawer 391, Sandpoint, Idaho.

Circle No. 6-24 on the convenient reply card facing page 34.

Impactor

The Model VR-84 self-propelled vibratory impactor compacts heavy clays as well as a wide range of other soils and granular materials. The machine is comprised of a two-wheel modified prime mover with the front carried on a steel roll with spring-mounted vibratory element. The prime mover wheels work on the compacted area, reducing drawbar power requirements. Dynamic impacts up to 25,000 lbs. within a

range of 600 to 1,400 impacts per minute are directed vertically. The unit consists of a 38-inch diameter steel roll 84 inches in length, spring-mounted in a steel frame confining the vibrations to the steel roll only. The impact mechanism is hydraulically powered.

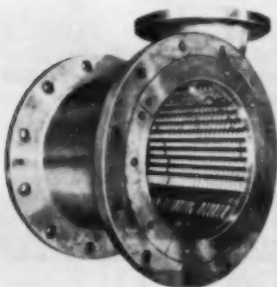
Seaman Corp. (Seaman-Gunnison Div.), Milwaukee, Wis.

Circle No. 6-22 on the convenient reply card facing page 34.



Grinding Pumps

Savings can be made in municipal and county sewage systems through a line of disc-type rotary pumps which grind up fibrous waste materials, as well as solids of all kinds, and discharge them into the sewage and polluted water flowing through the sewers. The disc-type rotary pumps can be supplied in various types, sizes and capacities to fit local specifications. Eliminating the necessity for grilles and screens to remove obstructive materials, the disc-type pumps feature simultaneous grinding and pumping action. The Model ZZ Pump is designed to handle textile wastes, rags and strong solids such



as wood or metal. In the case of normal sewage content, Model RS is recommended. Both Models ZZ and RS can be supplied in horizontal and vertical wet assembly.

Netherlands Trade Commission, 10 Rockefeller Plaza, Suite 1123, New York 20, N.Y.

Circle No. 6-25 on the convenient reply card facing page 34.

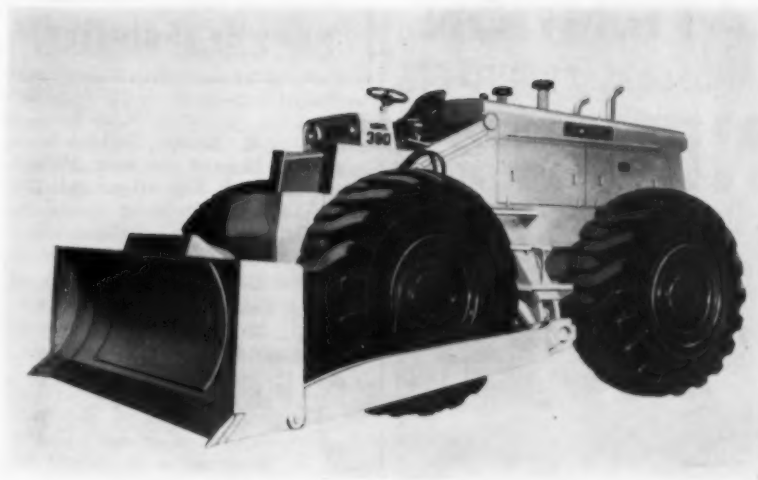
King-Size Pipe

In response to the growing demand for longer pipe and fewer joints, 5-foot vitrified clay pipe in 4, 6, 10 and 12-inch diameters is now available in addition to the 8 and 15-inch through 24-inch diameters.

Logan Clay Products Co., Logan, Ohio

Circle No. 6-26 on the convenient reply card facing page 34.

PUBLIC WORKS for June, 1961



Tractor Power

Two horsepower-increasing engine options for the Michigan Model 380 (Series II) tractor dozer are coupled with other design modifications for power and production capacity increases in the tractor dozer. First of the optional engines is the General Motors Model 12V-71,

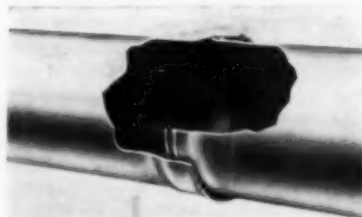
a 430 hp diesel. The other power plant is the Cummins Model NVH, a 12 cylinder diesel rated at 450 hp.

Construction Machinery Division, Clark Equipment Company, Benton Harbor, Mich.

Circle No. 6-27 on the convenient reply card facing page 34.

Steel Pipe Joint

Savings in the cost of laying large-diameter steel water mains are possible by the use of bell-and-spigot rubber gasketed joints, commonly known as O-rings. The pipe is available in diameters from 24-in. through 120-in. ID, and in 40-ft.



BOND GASKET (DEFORMED) GASKET RETAINER BAR

lengths. With the O-ring, a workman can complete a joint in a matter of minutes. Hydrostatic tests indicate that the rubber-gasketed joints have excellent leak-free characteristics. Deflections possible with the new joint vary with the pipe diameter and wall thickness.

Bethlehem Steel Co., Bethlehem, Pa.

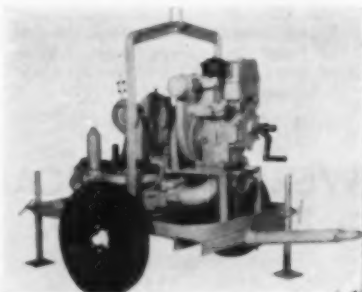
Circle No. 6-28 on the convenient reply card facing page 34.

Diaphragm Pumps

This series of four air-cooled diesel powered self-priming diaphragm pumps includes both single and double diaphragm pumps available with 2, 3 and 4 inch openings. Swing type valves are offered as standard equipment, with ball type valves optional. Capacities range from approximately 1,500 to 18,000 gallons per hour. The diesel engines currently offered are 4-cycle air cooled, crank start types, with electric starters as optional equipment. Controlled weights throughout the overall design permit the use of high speed trailers.

Rice Pump & Machine Co., Belgium, Wisc.

Circle No. 6-29 on the convenient reply card facing page 34.



ATTENTION LANDSCAPE ARCHITECTS NEW CHEMICAL CONCENTRATE ENDS REST AREA PRIVY ODORS!



Get Complete Proven Success with SANI-SEPTIC CONCENTRATE FORMULA—500—I. R. B.

Revolutionary new Sani-Septic Concentrate is a complete new approach to the problem of rest area odor control. The result of extensive research and development, Sani-Septic Concentrate destroys the bacteria that are the source of privy odors. Unlike other products, Sani-Septic is not a perfume or odor "cover-up." It leaves no odor of its own. Sani-Septic is a liquid that is diluted with water and poured into the privy vault. It destroys present odors and future odors. It is economical to use and is unconditionally guaranteed to provide the sanitation required. Test installations in the State of Ohio rest areas and roadside parks have proven the unique effectiveness of Sani-Septic Sanitation.

Why Sani-Septic Destroys Odor

Sani-Septic Concentrate completely ends odor where others fail because it controls the growth of the micro-organisms that produce sulphides with their strong unpleasant odors. In addition it prevents the growth of fungi that speeds decomposition of waste materials and resulting offensive odors.

Send for complete information.

WERLEY CHEMICAL & SUPPLY CO.

1505 Broadway
Cleveland 15, Ohio

NEWS OF ENGINEERS

HERBERT E. HUDSON, Jr., has been appointed to head the new AWWA Committee on Education and Dr. T. E. LARSON has been named as chairman of the Committee on Research. Mr. Hudson is a partner in the consulting engineering firm of Hazen & Sawyer and Dr. Larson is head of the Chemistry Section of the Illinois State Water Survey.

EARL F. KELLEY, one-time chief of the Division of Physical Research of the Bureau of Public Roads, died in Washington in April. He retired in 1956 after 36 years of service.

ROBERT E. NOVICK has been appointed by the Public Health Service as regional program director for engineering services in the Denver, Colo., area.

HOWARD B. HELSCHER, Cedar Rapids, a real estate man, has been appointed Iowa State Highway Commissioner.

DR. ROBERT W. VAN HOUTEN, president of the Newark College of Engineering has been elected president of the American Society for Engineering Education. Vice presidents are Dr. GEORGE A. MARSTON, dean of the University of Massachusetts and Dr. CURTIS L. WILSON, dean of the Missouri School of Mines and Metallurgy.

G. BROOKS EARNEST, president of Fenn College, Cleveland, O., is the official nominee for president of the American Society of Civil Engineers for 1962. Honorary members of the society have been elected as follows: ABEL WOLMAN, GEORGE S. RICHARDSON, THORNDIKE, SAVILLE and SAMUEL B. MORRIS.

OSWALD J. MUEGGE, Wisconsin State Sanitary Engineer, is one of five men in engineering and industry selected for citations at the 13th Annual Wisconsin Engineers' Day of the University of Wisconsin. The awards will be presented on May 5. Mr. Muegge, a 1923 graduate of the University, has been state sanitary engineer since 1949.

PHILIP F. MORGAN, Professor of Sanitary Engineering, State University of Iowa, died last January following a long illness. Widely known and highly regarded for his work in the sanitary engineering

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FACING GRAND CIRCUS PARK
DETROIT, MICHIGAN

Harry E. Paulsen, Gen. Mgr.

field, Prof. Morgan received many awards and honors.

* ROBERT G. THOMAS has joined the consulting firm of Stetson, Strauss & Dresselhaus, Inc., Los Angeles, as chief engineering geologist. Mr. Thomas was formerly with the California Dept. of Water Resources.

JOHN O. FULMER, JR., and JOHN F. STRANGARITY, JR., have been made vice-presidents of Glace & Glace, consulting engineers of Harrisburg, Pa.

LIEF J. SVERDRUP will receive the 1961 NSPE Award for outstanding service to the engineering profession at the annual meeting in Seattle in July. Mr. Sverdrup is president of Sverdrup & Parcel, Inc., consulting engineers.

WALDO G. BOWMAN, Editor of *Engineering News-Record*, has been selected as Metropolitan Civil Engineer of the Year by the Metropolitan Section of the American Society of Civil Engineers.

FILMS

in Brief

Listed below are motion picture films of current interest to engineers, administrators and supervisors in the public works field. The companies providing these films have indicated that the films are available for appropriate use by PUBLIC WORKS readers. Requests for films should be made direct to the company listed with the film.

"Operating Heavy Duty Trucks Safely." A training film that covers the operation of earth-moving trucks. Filmed on-the-job, it covers hazards encountered and safe practices in driving, dumping, towing (film.) National Safety Council in care of Association Films, Inc., 561 Hillgrove Ave., La Grange, Ill.

and loading. (Black and white slide.)
"Way Over The Mountain." The story of the construction of the Anderson Dam in Boise, Idaho, depicting the part conveyor belts play in the giant undertaking. (27 min., black and white, sound, 16 mm.) The Goodyear Tire & Rubber Co., Akron 16, Ohio.

"Steel Spans the Chesapeake." The erection of the 4-mile bridge across the Chesapeake Bay featuring six different kinds of bridge spans. (37 min., color, sound, 16 mm.) Bethlehem Steel Co., care of

Modern Talking Pictures Service, 21 W. 60th St., New York 23, N.Y.

"George Washington's River." Portrayal of pollution of the lower Potomac River, problems basic to those of every polluted river in the country. Film shows methods by which cities and industries can clean up their wastes and their streams. (28 min., color, sound, 16 mm.) U.S. Public Health Service, Division of Water Pollution Control, Washington 25, D.C.

"Alaska, The Big Country." Shows the use of Armco products in Alaska, accompanied by excellent scenic shots of this new State. (17 min., color, sound.) Armco Steel Corp., Production Section, Advertising Department, 703 Curtis Street, Middletown, Ohio.

"Highways Unlimited." Dedicated to the road builders of the nation, showing P & H equipment working on road construction. (16 min., color, sound, 16 mm.) Harnischfeger Corp., 4400 W. National Ave., Milwaukee 46, Wis.

"Advanced Welding Techniques." Explains the use of the correct electrode for specified welding jobs along with other practical aspects of welding techniques. (10 min., color, sound, 16 mm.) Motion Picture Department, Westinghouse Electric Corp., 3 Gateway Center, Pittsburgh 30, Pa.

"Blasting Vibrations: Cause and Effect." What happens when a dynamite blast goes off "down the road" is explained to a worried housewife with a discussion of vibrations and blast effects. (23 min., color, sound, 16 mm.) Advertising Dept., Hercules Powder Co., Wilmington 99, Delaware.

"What They Don't Know Can Hurt." A lesson on the need for showing workers the right way to do a job. (Black & white, 16 mm.) National Safety Council, care of Association Films, 561 Hillgrove Ave., La Grange, Ill.

• • •

PHS Summer Training

At Rutgers University, New Brunswick, N. J., the Public Health Service will present a summer training institute from July 16 to 21. The Cincinnati SEC will provide staff and special equipment for courses in air pollution, radiological health and water quality management. Registration fee is \$15; dormitory fees vary. For details and application forms write S. C. Martin, Regional Engineer, Public Health Service, 42 Broadway, New York 4, N. Y.

CLASSIFIED

Position Available Water Plant Operator

A municipally owned and operated well water supply system including new treatment plant located in Camden County, New Jersey, invites applications from men 35 to 50 years of age with at least 5 years responsible operational experience in water filtration plants. Salary \$7000 to \$7500 depending on qualifications. Interested applicants should send complete resume of experience and personal data to:

Box 6-1,
Public Works Magazine
200 South Broad St.,
Ridgewood, New Jersey

BRIDGE AND HIGHWAY ENGINEERS

Several experienced highway bridge and road engineers wanted by established Consulting Firm, Chicago location. Excellent benefits and permanent position for qualified applicants. Give education, experience and approximate salary requirements.

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Assistant Township Engineer

Township of Woodbridge, New Jersey, Population 78,000, is receiving application for the position of Assistant Township Engineer. Work includes the development of engineering for municipal projects, such as roads, sewers, storm drains and other Public Works projects. Training and experience required: Two years Public Works Engineering and a Civil Engineering Degree. Salary open.

For information contact:

Carl F. Wheeler
Township Engineer
1 Main Street
Woodbridge, New Jersey

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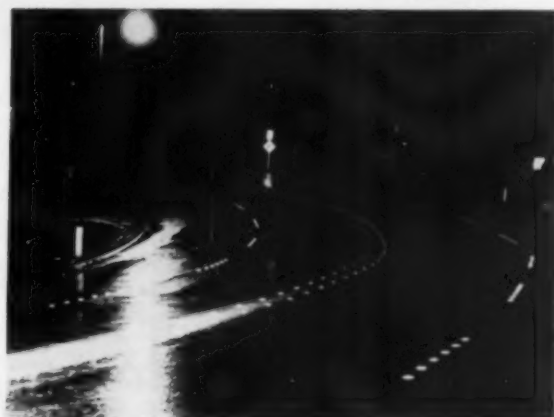


Step savers. Hayward, California, uses 3-wheel utility vehicles made by Cushman Motors for its water department meter readers and maintenance men. Savings are estimated at \$1,500 per year.

Portable drill powered by International UD-236 diesel engine digs holes three to nine ft. deep for new signs and guide markers on Interstate Highway 70. Digging takes only two to five min.



New stadium for the District of Columbia will be illuminated with 2,136 Westinghouse floodlights like the one in the foreground. Four power centers will control circuits.



Safe traffic channeling on a hazardous curve is provided by these low profile, reflective plastic discs. This Lite-Lane traffic guide system is an American Marietta product.



Asbestos-asphalt mix is undergoing service tests on a section of a jet taxi strip at Dorval Airport, Montreal. Two test mixes were used, one with 3 percent and one with 2 percent asbestos fiber supplied by Johns-Manville.

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products
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by Arthur K. Akers

★ **Cast Iron Pipe News**, published by that Association, features our good friend **Henry J. Graeser**, superintendent of Dallas City Water Works, in their April-May issue.

★ **Charles M. Comstock**, formerly advertising manager, Dorr-Oliver, Stamford, Conn., is advanced to manager of newly-formed Comple-



Mr. Comstock



Mr. Lambeth

Treator Sales Division. **George F. Lambeth** replaces him as advertising and publicity manager.

★ **G. A. Robinson**, Washington, D. C., is again named president of National Clay Pipe Manufacturers, Inc. An expanded program of research and materials testing is also announced.

★ **Young Spring & Wire Corp.**, Bowling Green, Ohio, consolidates its Daybrook Hydraulic and Ottawa Steel Divisions to be known now as the Equipment Division, with **T. W. Helwig** as president.

★ The Penn Meter Co., Philadelphia 4, succeeds by purchase the Penn Instrument Div., formerly owned by Burgess-Manning Co. **W. E. Williams** will be president-sales manager, continuing the same line of flow instruments.

★ **Carus Chemical Co., Inc.**, La Salle, Ill., elects two new vice presidents: **Paul Carus**, manufacturing, and **M. Blouke Carus**, sales and personnel.

★ **Centriline Corp.**, New York, opens a Chicago office at 111 W. Monroe St. with **Donald A. Stolzman** as midwest district manager there.

★ **Earl H. Bradley**, president of B-I-F Industries, Inc., Providence, announces negotiations for purchase of this old New England company by the New York Air Brake Co. No changes in personnel, products or policies are contemplated.

★ **Walter E. Schirmer** elected executive vice president of Clark Equipment Co., Buchanan, Mich.

★ **Thomas O. Carson** is named assistant vice president, Meter & Valve Div. Sales, Rockwell Mfg. Co., Pittsburgh.

★ **William S. Gaskill** appointed general sales manager Stanco Mfgs. & Sales, Inc., Santa Monica, Calif. (FLYGT submersible electric pumps.)

★ **Marvin Lane** is upped from general manager to president of Graver Water Conditioning Co. Division of Union Tank Car Co.

★ **Wayne Mfg. Co.**, Pomona, Calif., manufacturers of street and power sweepers, appointed **Harold C. Clark** as Chicago branch manager succeeding **Ken L. Harvey**, transferred to Pomona.

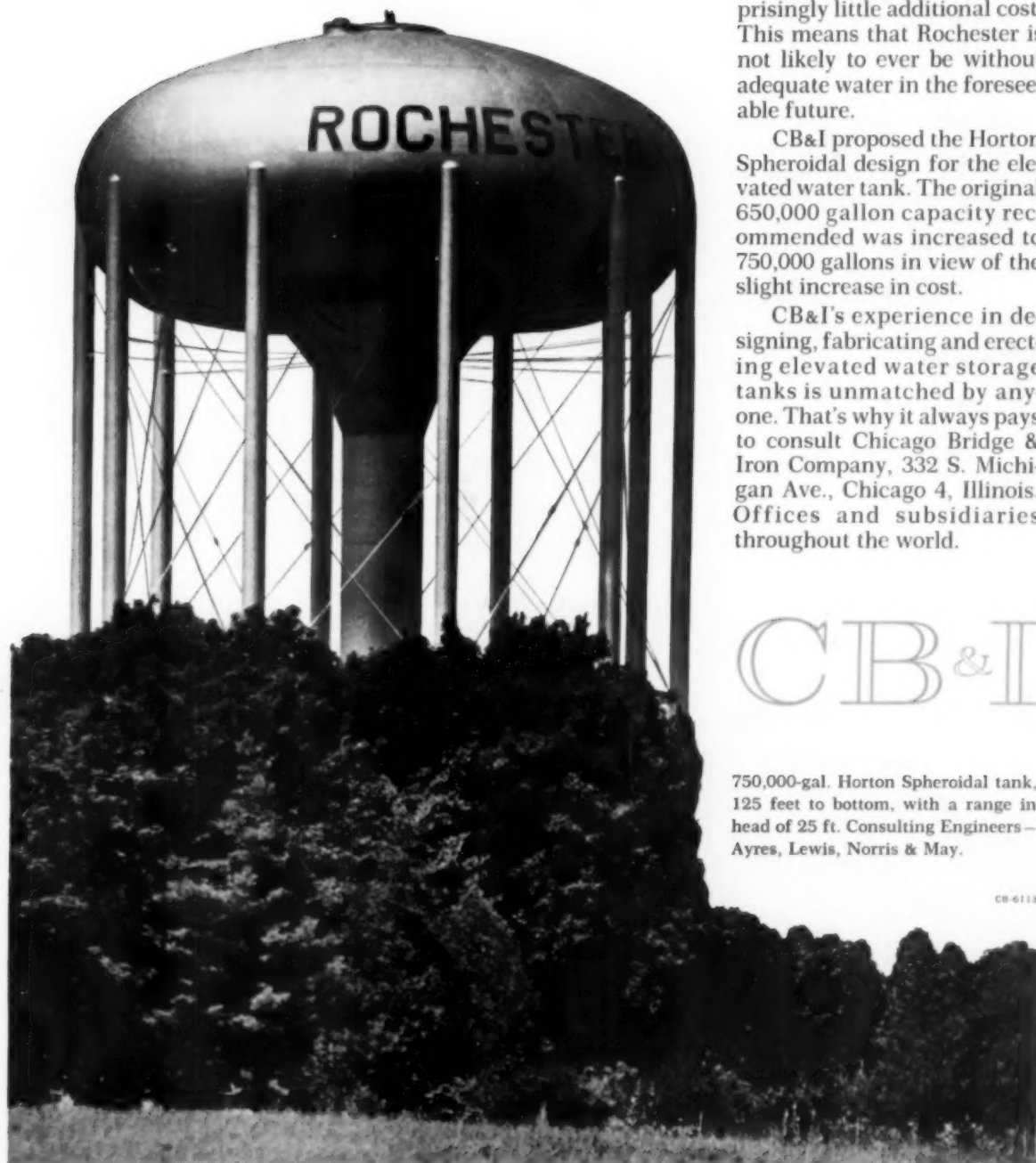
★ **Southwestern Plastic Pipe Co.**, Mineral Wells, Texas, has purchased **Ken-Way Plastic Products Corp.**, Phoenix, Ariz. Ken-Way's name will be changed to that of the new parent company of Arizona, with **E. F. Clemens**, president; **Eugene C. Clemens**, first vice president; and **J. F. Bailey**, executive vice president.

★ **Municipal Service Co.**, Kansas City, now announces its associated **Municipal Utilities Co.** has four operating water and sewage utilities and states it is currently negotiating with a good number of private as well as public corporations.

★ **Stranger**, to broker: "I have an investment problem." Broker (sensing commissions): "That's my business. What is your problem?" Stranger: "That I haven't any money."

PUBLIC WORKS for June, 1961

An Additional
100,000 Gallon Capacity
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A 750,000 gallon elevated steel water tank for a village of 5,400 people may sound like a luxury. Actually it is, to the extent of 100,000 gallons excess capacity over present requirements. However, this extra capacity was provided at surprisingly little additional cost. This means that Rochester is not likely to ever be without adequate water in the foreseeable future.

CB&I proposed the Horton Spheroidal design for the elevated water tank. The original 650,000 gallon capacity recommended was increased to 750,000 gallons in view of the slight increase in cost.

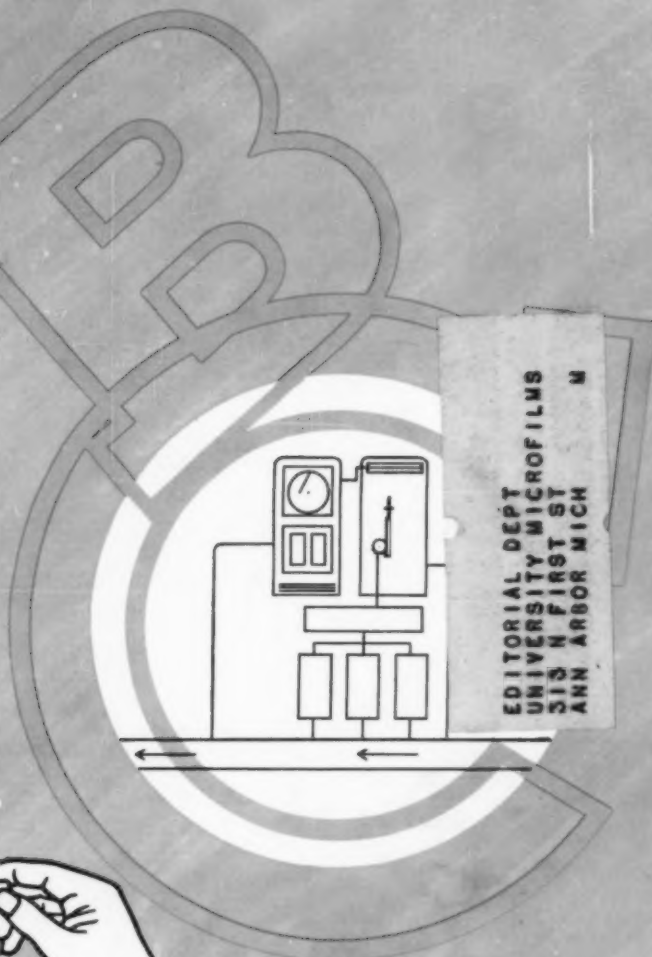
CB&I's experience in designing, fabricating and erecting elevated water storage tanks is unmatched by anyone. That's why it always pays to consult Chicago Bridge & Iron Company, 332 S. Michigan Ave., Chicago 4, Illinois. Offices and subsidiaries throughout the world.

CB&I

750,000-gal. Horton Spheroidal tank, 125 feet to bottom, with a range in head of 25 ft. Consulting Engineers—Ayles, Lewis, Norris & May.

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